NASA-CR-196017

Final Report
Grant No. NAG-1-1013
June 1, 1989 - March 31, 1994

217

ANALYSIS OF HIGH SPEED FLOW, THERMAL AND STRUCTURAL INTERACTIONS

Submitted to:

National Aeronautics and Space Administration
Langley Research Center
Hampton, VA 23681-0001

Attention:

Allan R. Wieting, Program Manager
SMD, M/S 395

Submitted by:

Earl A. Thornton
Professor

SEAS Report No. UVA/528308/MANE94/101
June 1994

DEPARTMENT OF MECHANICAL, AEROSPACE AND NUCLEAR ENGINEERING

SCHOOL OF
ENGINEERING
& APPLIED SCIENCE

University of Virginia
Thornton Hall
Charlottesville, VA 22903

Final Report
Grant No. NAG-1-1013
June 1, 1989 - March 31, 1994

ANALYSIS OF HIGH SPEED FLOW, THERMAL AND STRUCTURAL INTERACTIONS

Submitted to:

National Aeronautics and Space Administration
Langley Research Center
Hampton, VA 23681-0001

Attention:

Allan R. Wieting, Program Manager
SMD, M/S 395

Submitted by:

Earl A. Thornton
Professor

Department of Mechanical, Aerospace and Nuclear Engineering
School of Engineering and Applied Science
University of Virginia
Charlottesville, VA 22903-2442

SEAS Report No. UVA/528303/MANE94/101
June 1994

Copy No.______

Analysis of High Speed Flow, Thermal
and Structural Interactions

Background

The research program began at the University of Virginia on June 1, 1989, with a series of one-year grants that ran through May 31, 1992. On June 1, 1992, a three year grant began that was to run through December 31, 1994. In a telephone call on March 16, 1994, the Technical Monitor informed the Principal Investigator that the grant was terminated effective December 31, 1993, due to a lack of funds. Research support during the grant period was supplemented by a parallel grant from the Aircraft Structures Branch at NASA LRC.

Research Tasks

Work in the grant focused on five tasks: (1) the prediction of severe, localized aerodynamic heating for complex, high speed flows, (2) finite element adaptive refinement methodology for multi-disciplinary analyses, (3) the prediction of thermoviscoplastic structural response with rate-dependent effects and large deformations, (4) thermoviscoplastic constitutive models for metals, and (5) coolant flow/structural heat transfer analyses.

Research Progress

Task 1: The research in Task 1 centered on development of an adaptive finite element space-marching algorithm applicable to problems governed by the parabolized Navier-Stokes equations. A space marching algorithm was developed and implemented for the Euler equations. The computer program was validated for inviscid problems with classical solutions including flow over a cone. A strategy for adaptive remeshing in cross-planes was developed and implemented. The two-dimensional remeshing program was tested extensively and was used in research under Tasks 2 and 5. The next step involved developing an approach for connecting adaptive meshes in two successive cross-planes. An approach was developed and implemented using tetrahedral elements. The adaptive space marching scheme was being evaluated at the time the grant was terminated. A Ph.D. dissertation describing the research is expected in late 1994 or early 1995.

Task 2: In the first two years of the research Professors Morgan and Peraire from the U.K. were supported through the grant, and they contributed significantly to this task. Their research has been reported directly to the Technical Monitor. Little effort was made at UVA for the development of finite element methodology for multidisciplinary problems. An attempt was made in Task 5 to use adaptive remeshing to model heat transfer in a convectively cooled plate. The objective was to model conduction in the plate and forced convection in the coolant. The attempt showed that some major programming difficulties are encountered in adaptive remeshing for this type of problem. Among these difficulties are: (1) nodes must be constrained to lie on the fluid-solid interface line within the mesh, and (2) different error indicators must be used for elements in the fluid and solid. These difficulties suggested the need for development of a completely new algorithm and computer program which was beyond the scope of the UVA effort.

Task 3: A significant effort was made in the investigation of the prediction of thermoviscoplastic structural response. Finite element investigations were first conducted for the thin plates in plane stress. Then work focused on development of a finite element algorithm for plate bending. At the same time an experimental program was conducted to provide data for validation of the finite element analysis.

In the experimental program Hastelloy-X plates were subjected to series of tests with transient localized heating at increasing levels. At low heating levels, the plate behavior was elastic, and at high heating levels the plate behavior was inelastic. Temperature, displacement and strain data were collected.

In the initial development of the nonlinear finite element analysis a constant strain triangle (CST) was used to represent the membrane behavior and direct Kirchhoff triangle (DKT) was used to represent plate bending. Element performance was evaluated first for a series of classical small and large deflection elastic problems. For these cases element performance was excellent. Then the experimental Hastelloy plates were analyzed for large displacement elastic behavior. For these tests agreement between analysis and experiment was good in the linear range but not very good in the nonlinear range. Typically greater nonlinear deflections were predicted than seen in the experiment. After careful study, the conclusion was reached that the discrepancy was related to the CST. The hypothesis was that the membrane stresses were not computed accurately and were adversely affecting the response in the large deflection range where membrane-bending coupling occurs. A higher-order membrane element was developed and was in the final stage of implementation in the computer program when the grant was terminated.

Task 4: An experimental material characterization program was conducted to provide data for Bodner-Partom constitutive models. Tests were conducted for Hastelloy-X and aluminum alloy 8009 for a broad range of strain rates and temperatures. Parameters for the Bodner-Partom constitutive models were determined for monotonic loading.

Task 5: Two investigations were conducted for finite element modeling of coolant flow and heat transfer analysis. In the first study a new finite element algorithm was developed to analyze low speed coolant flows with temperature-dependent density. The algorithm was validated with comparisons to published constant density solutions. A locally heated, convectively cooled plate was analyzed, and the effect of the variable density assessed.

In the second study adaptive remeshing was used to model low speed variable density flow. The solution algorithm employed was based on an equal order velocity and pressure interpolation scheme introduced by Schnipke and Rice. For some test problems the adaptive remeshing approach improved solution quality, but for other problems there was no clear benefit provided by remeshing. In some problems, a graded structural mesh produced better results than adapted unstructured meshes.

Grant Publications

The research progress described in the tasks above is documented in conference papers, journal articles and theses. In addition, the enclosed report "Experimental Study of Hastelloy-X Plate Buckling Deformations Induced by Spatial Temperature Gradients" documents the plate tests with complete experimental data.

Conference Papers:

1. Thornton, Earl A., "Thermal Structures: Four Decades of Progress," 31st AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, Long Beach, CA, April 2-4, 1990, AIAA Paper No. 90-0971.

2. Thornton, Earl A., and Kolenski, J. D., "Viscoplastic Response of Structures with Intense Local Heating," 32nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, Baltimore, MD, April 8-10, 1991, AIAA Paper No. 91-1149.

3. Thornton, Earl A., "Light Thermal Structures and Materials for High Speed Flight," Computational Structures Technology for Airframes and Propulsion Systems, NASA Langley Research Center, Hampton, VA, September 4-5, 1991, NASA CP 3142, pp. 231-251.

4. Thornton, Earl A., Coyle, M. F., and McLeod, R. N., "Experimental Study of Plate Buckling Induced by Spatial Temperature Gradients," 33rd Structures, Structural Dynamics and Materials Conference, Dallas, TX, April 13-15, 1992, AIAA Paper No. 92-2540.

5. Thornton, Earl A., Kolenski, J. D., and Marino, R. P., "Finite Element Study of Plate Buckling Induced by Spatial Temperature Gradients," 34th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, La Jolla, CA, April 19-21, 1993, AIAA Paper No. 93-1572.

6. Thornton, Earl A., Coyle, M. F., and McLeod, R. N., "Thermal Buckling Tests of Plates with Spatial Temperature Gradients," SEM Conference on Structural Testing Technology at High Temperatures II, November 8-10, 1993, Ojai, CA.

7. Rowley, Mark A., and Thornton, Earl A., "Constitutive Modeling of the Visco-Plastic Response of High Temperature Alloys," AIAA/ASME/ASCE/AHS/ASC 35th Structures, Structural Dynamics and Materials Conference, Hilton Head, SC, April 18-21, 1994, AIAA Paper No. 94-1593.

Journal Articles:

1. Thornton, Earl A., "Thermal Structures: Four Decades of Progress," *Journal of Aircraft*, Vol. 29, No. 3, May-June 1992, pp. 485-498.

2. Thornton, Earl A., "Thermal Buckling of Plates and Shells," *Applied Mechanics Reviews*, Vol. 46, No. 10, Oct. 1993, pp. 485-506.

3. Thornton, Earl A., and Kolenski, J.D., "Viscoelastic Response of Structures for Intense Local Heating," *Journal of Aerospace Engineering*, Vol. 7, No. 1, Jan. 1994, pp. 50-71.

4. Thornton, Earl A., Coyle, Marshall F., and McLeod, Rory N., "Experimental Study of Plate Buckling Induced by Spatial Temperature Gradients," *Journal of Thermal Stress*, Vol. 17, 1994, pp. 191-212.

5. Yarrington, Phillip W., and Thornton, Earl A., "Finite Element Analysis of Low-Speed Flows within Convectively Cooled Structures," Accepted for publication in the AIAA *Journal of Thermophysics and Heat Transfer.*

Theses:

1. Kolenski, J. D., "Large Deflection Thermal Buckling Analysis of Plates by the Finite Element Method," M.S., August 1992.

2. Yarrington, P. W., "Finite Element Analysis of Low-Speed Compressible Flows within Convectively Cooled Structures," M.S., May 1993.

3. Rowley, Mark A., "Characterization of the Viscoplastic Response of High Temperature Alloys," M.S., May 1993.

4. Song, Y. S., "Adaptive Finite Element Analysis of Flow in a Convectively Cooled Structure," M.S., April 1994.

5. Hernan, Paul R., "Finite Element Analyses of Plate Thermal Buckling Tests--Comparison of Analyses and Experiments," M.S., April 1994.

Dissertations in Progress:

1. Giraldo, Francis X.,"A Space Marching Adaptive Remeshing Technique Applied to the 3-D Euler Equations"

2. McLeod, Rory N.,"Experimental Investigation of Flow-Thermal-Structural Interactions"

3. Coyle, Marshall F.,"Thermal Buckling of Plates due to Localized Heating: An Experimental Investigation"

APPENDIX

EXPERIMENTAL STUDY OF HASTELLOY X PLATE BUCKLING DEFORMATIONS INDUCED BY SPATIAL TEMPERATURE GRADIENTS

Earl A. Thornton
Professor

Marshall F. Coyle
Graduate Research Assistant

Rory N. McLeod
Graduate Research Assistant

and

Joseph R. Blandino
Graduate Research Assistant

Department of Mechanical, Aerospace and Nuclear Engineering
University of Virginia
Charlottesville, VA 22903-2442

June 1994

ABSTRACT

An experimental study of plate buckling induced by spatial temperature gradients is described. A rectangular Hastelloy-X plate is subjected to local line heating by a focused quartz heat lamp. Two parallel plate edges are maintained at constant temperature by coolant flow. Point supports provide well-defined thermal-structural boundary conditions. Test results including temperatures and displacements from transient elastic and inelastic tests demonstrate that substantial plate bending occurs due to initial plate warpage and thermally induced membrane compressive stresses.

TABLE OF CONTENTS

INTRODUCTION

As hypersonic vehicles accelerate at high speeds in the atmosphere, shocks sweep across the vehicle interacting with local shocks and boundary layers. These interactions expose structural surfaces to severe local pressures and heat fluxes. One example of these interactions is leading edges of integrated engine structures which experience intense, highly localized aerothermal loads. Reference 1 studies issues relevant to the thermal-structure response of hydrogen cooled, super thermal-conducting leading edges subject to intense aerodynamic heating. Reference 2 describes a three dimensional thermal structural analysis of a swept cowl leading edge subjected to skewed shock-shock interference heating. The analysis shows that due to the intense localized heating, the thin elastic leading edge experiences very large (300 ksi) local compressive stresses. The high level of these compressive stresses suggests the possibility of localized inelastic behavior and/or local buckling.

Until recent years the study of structural response at elevated temperatures due to dynamic loads was not possible because of an inability to model inelastic material behavior. Over the last twenty years, unified viscoplastic constitutive models have evolved to meet this need. These constitutive models provide a means for representing a material's response from the elastic through the plastic range including strain-rate dependent plastic flow, creep and stress relaxation. Rate-dependent plasticity effects are known to be important at elevated temperatures. Unified constitutive models implemented in finite element programs provide an important simulation capability. Finite element analysis with unified constitutive models have been under development for about 15 years. Reference 3 describes these efforts and presents a thermoviscoplastic finite element computational method for hypersonic structures. Applications of the approach to convectively cooled hypersonic structures illustrate the approach and provide insight into the transient viscoplastic behavior at elevated temperatures.

Reference 4 presents a comprehensive literature review of research on thermal buckling of plates and shells since the first work in the 1950s. An assessment of past research is made, and

future research needs are highlighted. Since the original investigations of Heldenfels and Roberts[5] and Gossard, Seide and Roberts[6], numerous investigators have studied thermal buckling and thermal postbuckling of plates. Until the 1980s most studies were performed for isotropic plates, but in the 1970s research was initiated for laminated composite plates. Almost all of the work has assumed: (1) perfectly flat initial configurations and (2) elastic behavior. With the exception of the original papers[5,6] and the recent paper by Teare and Fields[7], all of the investigations have been analytical or computational; there have been no further experimental studies. There is a need for further experimental studies of thermally induced buckling for both isotropic materials and laminated composites. Applications to aircraft structures strongly suggest that experimental programs be conducted for plates with spatial temperature variations.

The purpose of this report is to describe progress in the Thermal Structures Laboratory to investigate experimentally the nonlinear response of plates subjected to localized heating. One objective of the experimental program is to provide data that can be used for validation of finite element viscoplastic analyses. The report begins with a description of a heat lamp characterization study. Then the thermal buckling experimental program is presented including a description of the test fixture, the plate heating procedure, thermal-structural boundary conditions and the instrumentation employed. Experimental results for heat fluxes, temperatures and displacements are presented and discussed. Data are presented to permit correlation with elastic and inelastic analyses.

HEAT LAMP CHARACTERIZATION

To achieve the strongly nonlinear plate bending response associated with high temperatures, significant levels of heating must be applied locally to the plate surface. Incident heat fluxes on the plate as it deforms must be known if temperature histories are to be predicted accurately. In the current study a concentrated high intensity infrared heat lamp is used to apply a heat flux to the test plate. A lamp characterization program has been undertaken to define the incident heat flux.

The heat lamp used in the test program (Research Inc., Model 5215-16) utilizes a tungsten filament quartz lamp and an elliptical reflector to concentrate the incident flux along a narrow focal line. The model employed is based on a 2.0 in. focal distance and concentrates the flux along a focal line of about 0.1 in. nominal width. The lamp is designed for industrial applications such as weld joint heating, line seam brazing, wire processing, etc. The reflector body is water-cooled, and the quartz lamp is air-cooled. At a rated voltage of 240 volts the heat lamp power rating is 1.6 kW (1.52 Btu/s), and at 480 volts the lamp power rating is 4.7 kW (4.46 Btu/s).

Several orientation tests were conducted with preliminary test plates instrumented with thermocouples to provide experience with lamp operation and familiarity with the incident heat flux distribution. Additionally, a few preliminary tests were made to measure incident heat flux distributions. These tests showed that there was a significant level of incident heat flux outside of the nominal 0.1 in. heated width and that the flux varied along the lamp length. Lower heat flux levels occurred near the lamp ends.

Since the intent of the test program was to provide a well-defined thermal environment, a lamp characterization program was conducted. A test fixture and test program was developed to determine the heat flux variation with lamp power and the incident flux spatial distribution. Billet tests were also performed to determine the emissivity of the incident surface used in the characterization program.

Lamp Characterization Tests

A schematic of the test fixture is shown in Fig. 1. The quartz heat lamp is operated with a process controller (Research Inc., Micristar, Model 28) and a SCR power controller (Research Inc., Model 664). The programmable process controller produces a 4-20 mA signal proportional to the control output percent. The phase angle power controller attenuates the 480 VAC line voltage at a level set by the signal supplied by the process controller. When attached to a purely resistive load, the supplied power is proportional to percent control output hereafter denoted as P.

To survey the incident heat flux supplied to a surface by the heat lamp a test fixture was constructed. The fixture shown in a photograph in Fig. 2 consists of the quartz lamp and a copper incident heated surface mounted on an x-y table. Both are supported by a thick aluminum plate. The quartz heat lamp can be moved by a manually operated lead screw along the z axis to vary the distance between the lamp and the incident heated surface. The incident heated surface is moved under the heat lamp using the x-y cross-table. Stepper motors turn lead screws which drive the x-y platforms. Stroke lengths are 12.4 in.(350 mm) in the x direction and 7.9 in.(200 mm) in the y direction. The lead screw has a pitch of 0.16 in (4 mm) per revolution. Using half-step control the stepper motors have 200 steps/revolution resulting in a resolution of 0.00079 in. (0.02 mm).

The coordinate system used for the lamp calibration tests is shown in Fig. 5. The origin is taken at the center of the lamp focal plane and is fixed in space. The focal plane corresponds to the top of the heated surface for $z=0$. For $z>0$, the heated surface has moved towards the lamp, and for $z<0$, the heated surface has moved away from the lamp.

Incident heat flux was measured on the surface of an 18.0 in. x 2.25 in. x 0.75 in. copper bar. The copper bar has seven 1.375 in. dia. x 0.1875 in. circular holes machined along its centerline every 2.0 in. on center. The bar was actively cooled by chilled water flowing through two copper cooling tubes attached in grooves machined in the lower surface of the copper bar. Incident heat flux was measured with three foil-type heat flux gages (RdF Corporation, P/N 20453-3 or P/N 20453-2). The heat flux gages were permanently mounted using a structural adhesive

(Hysol Aerospace Products part number EA 9394) in a 0.5 in. x 0.5625 in. x 0.02 in. cutout in a copper disk, which was machined to fit into the holes in the actively cooled surface. Copper inserts were placed in the four remaining holes in the surface. The arrangement of the gages is shown in Fig. 4. Mounting the gages on copper disks, which could be removed from the heated surface, allowed them to be sent to NASA Langley Research Center for calibration. The surface, disks and gages were painted flat black (Tempil, Big Three Industries, Inc., Pyromark 800).

Early in the lamp calibration program a need to calibrate heat flux gages became apparent. The manufacturer's calibration data was determined to be inaccurate. For example for a given gage, data between runs showed excellent agreement. However, data correlation between gages was very poor. The gages were sent to the NASA-LaRC heat flux gage calibration facility. Following calibration, the difference in heat flux values between gages was less than ±5%. NASA-LaRC calibrated the heat flux gages based on incident heat flux.

Because the heat flux gages were calibrated based on incident rather than absorbed heat flux, a series of billet tests were run to determine the emissivity of the flat black paint used during the heat flux characterization and plate tests. Three copper billets 0.9 in. x 0.6 in. x 0.2 in. were used for the test. A small hole was drilled into the center of the billet, and a type T thermocouple soldered in place. A ceramic holder was machined so that the billets would be held snugly in place and insulated on five sides. The ceramic holder was then placed on top of the convectively cooled surface such that the billets would be located at x = -2.0, 0.0, 2.0 in, and z = 0.0 in. The lamp was turned on and the billet temperature allowed to rise to 350°F. As soon as one billet reached 350°F the lamp was turned off. Results from a typical billet test are shown in Fig. 5. The emissivity was assumed equal to the absorbtivity and calculated from the initial slope of the billet test results. the equation used for the calculation was,

$$\alpha = \frac{\rho ch}{q}\frac{dT}{dt} \qquad (1)$$

where ρ is the billet density, c is the billet specific heat, h is the billet thickness, and q is the

incident heat flux. A comparison between the results obtained directly from the heat flux gages and those calculated from the billet tests indicate an emissivity of 0.86 for the flat black paint.

Two series of lamp tests were conducted. In the first test series lamp power and incident heat flux were measured as a function of the control output percent P. Three heat flux gauges were placed on the heated surface. During a test, heat flux, lamp voltage and current are measured and recorded. During a test, the control output percent, P, was ramped from 0-85% in 1% increments. Heat flux was measured at three x locations. Heat flux gage 1 was located at $x = -2.0$ in., $y = -1.0$ in., $z = 0.0$ in.; gage 2 was located at $x = 0$ in., $y = -1.0$ in., $z = 0.0$ in.; and gage 3 was located at $x = 2.0$ in., $y = -1.0$ in., $z = 0.0$ in.

The second series of tests consisted of measuring heat flux distributions for three control output levels, P = 5%, 10%, 15%. These correspond to power outputs of 0.223, 0.446, and 0.668 Btu/s, respectively. Although power levels changed less than 3% over the course of a test, initial power levels varied as much as 20% from the target outputs presented. This initial drift was attributed to changes in the bulb filament temperature at low power levels. Thus it caused a change in the electrical resistance of the filament resulting in a change in voltage (the controller held current constant). Variations in initial power were accounted for in the data analysis .

An automated series of seven passes (one test) traversing along the y-axis were made at each height z for each power setting. The series of seven passes were repeated three times for each height/power combination and averaged. Limits of the motion along the y-axis were ±2.0 in (50 mm) from the centerline, and readings were taken at intervals of 0.02 in. (0.5 mm). The gage positions, in inches from lamp centerline, along the x axis during each pass are given in Table 1. An illustration of the heated surface relative to the lamp for passes 1, 2, and 7 is shown in Fig. 6. The height z was varied in 0.125 in. increments from $z = -0.375$ in. to $z = +0.375$ in..

Table 1.

Gage x Positions (inches) for Heat Flux Tests

Pass	Gage 1	Gage 2	Gage 3
1	-8.0	-6.0	-4.0
2	-6.0	-4.0	-2.0
3	-4.0	-2.0	0.0
4	-2.0	0.0	2.0
5	0.0	2.0	4.0
6	2.0	4.0	6.0
7	4.0	6.0	8.0

Lamp Heat Fluxes

From the first test series the results shown in Fig. 7(a) indicate that the heat flux varies non-linearly with control output level P for power levels less than 0.668 Btu/s. However, for power levels greater than 0.668 Btu/s, Fig. 7(b) shows that the lamp power and heat flux change nearly linearly. Heat flux distributions determined in the second series of tests are shown in Figs. 8-10. Figure 8 shows the heat flux variations with y at the lamp centerline, $x = 0$, for 0.223, 0.446, and 0.668 Btu/s. The distribution along the y-axis displays a sharp rise in the heat flux to a maximum along the focal line, but there are significant heat flux levels away from the centerline. Figures 9 and 10 show how the heat flux varies along the y-axis when z changes. Figure 9 depicts the heat flux distribution when the lamp is moved 0.375 in. closer to the incident surface. The flux distribution is similar to that at the focal plane except that the peak is slightly lower, and the flux is spread over a larger area. However, Fig. 10 reveals a heat flux distribution which is very different than that at the focal plane. The distribution shows two peaks at approximately ±0.3 in. This case represents the flux distribution when the lamp is moved 0.375 in. away from the lamp. The sharp focal line is "out of focus". The focal line, approximately 0.1 in. wide at the focal plane, is smeared to approximately 0.6 in. wide. This 0.6 in. strip has higher heat fluxes at its edges with a "dark area" of drastically reduced heat flux in the center.

For the plate buckling tests to be described in the next section, the upper plate surface was insulated except for the narrow rectangular strip $x = \pm 0.25$ in.. To develop an analytical representation for the heat flux distribution over this region, average heat fluxes were determined at seven x locations by integration of the heat fluxes between $-0.25 < y < 0.25$.

Non-dimensional average heat flux distributions q(x) along the x-axis are shown in Fig. 11 for P = 0.668 Btu/s. These distributions show the variation of the heat flux with x clearly. The distributions are not symmetric about the lamp axis x. Further tests indicated that the non-symmetric heat flux distribution along the x-axis were due to the quartz bulb not being perfectly aligned inside the lamp body. Assuming a perfectly aligned bulb, the heat flux distribution was represented by a second order polynomial which is symmetric about the x-axis centerline and varies with height z. The equation is:

$$f(x,z) = ax^2+b+cz \qquad (2)$$

where the values of the coefficients are given in Table 2.

Table 2.

Coefficients for Heat Flux Distribution q(x)

	P(Btu/s)		
Coefficient	0.223	0.446	>0.668
a	-0.0014	-0.0015	-0.0014
b	0.3036	0.3327	0.3340
c	0.0827	0.0999	0.0968

As mentioned above the heat flux levels vary linearly with P above 0.668 Btu/s. Additionally, the heat flux varies linearly with z within the range tested. Based on these results an approximate empirical representation for the heat flux q for a plate test was developed,

$$q(x,z,P) = (18.46P)(ax^2 + b + cz) \qquad \text{(BTU/ft2-s)}$$

where P is in Btu/s, and values the coefficients a, b, and c are given in Table 2. Note that these coefficients are constant for $P > 0.668$ Btu/s and are valid for $z = \pm 0.375$ in.

PLATE BUCKLING TESTS

The experimental investigation of plate buckling is based upon the original experiments[5,6] conducted at NACA Langley in 1952 but with significant changes. The current investigation places emphasis on determining a plate's transient, inelastic response. The experimental results are intended for validation of transient finite element analyses including geometric and material nonlinearities.

Test Description

The test fixture for a plate typical buckling test is described schematically in Figure 12. A 15 in. x 10 in. x 1/8 in. Hastelloy-X plate is heated along its centerline by the incident flux from the quartz lamp. The two parallel plate edges are maintained at constant temperature by chilled water flowing through 5/8 in. polybutylene tubes. The edges of the plates are inserted in slots machined in the polybutylene tubes and sealed with a silicone- based RTV adhesive. The polybutylene coolant tubes have negligible bending stiffness which is shown later in the Isothermal Test section of this report. The plate is supported at four points to provide well-defined structural boundary conditions and to minimize heat loss. To prevent in-plane motion, one support uses a cone-shaped point set in a small indentation in the plate. At the other three points, 1/4 in. dia. spherical contacts are employed. The dimensions of a test plate, the support locations, the coordinate system and other details are shown in Fig. 13.

The plate is heated over a narrow rectangular strip along its centerline. The heated strip is 1/2 in. wide and was painted with Tempil Pyromark 2500 flat black paint. This paint has nearly the same absorptivity and emissivity as the Pyromark 800 paint used in the lamp characterization tests. Except for this strip, the test plate and coolant tubes are encased in insulation. Approximately 1.0 in. of ceramic fiber blanket insulation is used on the upper surface, and 2.0 in. of insulation is used on the lower surface. The reason for the lower surface having more insulation than the top was to fill a void in the test fixture.

Test Procedures

Nine Hastelloy-X 15 in. x 10 in. x 1/8 in. plates with certificate of originate and composition were purchased from ATEK Metals Center. ATEK used a shear to cut the plates to size. The tolerance on length and width was found to be +0.04, -0.00 in. These plates were sent to NASA-LaRC to have their initial shape measured. The Hastelloy-X plate tested was taken from this lot. It was found to have a thickness ranging from 0.1224 in. to 0.1283 in. with an average thickness of 0.1259 in. and a maximum Δz (difference between the maximum and minimum plate's mid-plane z coordinate) of 0.0182 in. The initial shape of the plate is shown in Figure 14. In the present tests, the plate deflected down away from the heat lamp. A copy of the material certificate along with the plate initial deformations (warpage) are presented in Appendix A.

In a typical plate test, the chill water system was operated initially for 30-60 minutes to bring the test plate to a uniform temperature of about 58-65°F. Coolant flow rate is sufficient to maintain the plate edges at the initial temperature for the duration of the test. A typical test was conducted by programming the process controller so that the lamp receives P% of maximum lamp power, and P is maintained at the specified level until the controller is manually shut off. Lamp characterization tests show that the quartz lamp rise time is about one to two seconds at P = 10 %. At higher power levels, the rise time is much smaller. Lamp power is controlled within about one percent over the duration of the test. For the present test series, the lamp power was shut off to keep the maximum plate temperature within a predetermined maximum limit. After the heat lamp was shut off, the plate response was monitored as temperatures returned to steady-state.

The Hastelloy-X plate was subjected to a series of five tests at increasing temperature levels. The first two tests were elastic, and the last three tests induced increasing levels of permanent deformation in the plate. The test series is summarized in Table 3.

Table 3.

Thermal Buckling Tests

Test No.	P (%)	P (Btu/s)	Max. Temp. (°F)	Time (s)	Behavior
1	5	0.1749	250	5400	Elastic
2	15	0.6403	375	300	Elastic
3	15	0.6423	500	600	Possibly Plastic
4	30	1.5410	700	200	Plastic
5	70	3.7043	1000	88	Plastic

Instrumentation

The plate was instrumented with 29 thermocouples (TC) to measure temperatures and 15 linear variable differential transformers (LVDTs) to measure transverse displacements. A PC based (micro computer) data acquisition system was used to monitor and record temperatures, displacements, and heat lamp power. The data acquisition system's maximum reading rate was 1.5 - 2 scans/s (one scan reads, converts, and records all data channels) The maximum reading rate was limited by the computer boards performing the temperature analog to digital (A/D) signal conversions. The scan rate was varied between tests depending on the flux levels. Scan rates for the tests are given in Table 4.

Table 4.

Scan Rates for Test.

	During Heating	During Cool Down
Test 1	Scan every 50 s	Scan every 50 s
Test 2	Scan every 5 s	Scan every 50 s
Test 3	Scan every 5 s	Scan every 50 s
Test 4	Scan every 2 s	Scan every 50 s
Test 5	Scan every 2 s	Scan every 50 s

The thermocouple locations are given in Table 5 and are shown in Figure 15. The thermocouples were made from 24 gauge type K thermocouple wire. Two pairs of thermocouples T5, T28 and T19, T29 are located "back-to-back" on the top and bottom surfaces of the plate to document temperature gradients through the plate thickness. An Unitek TC Welder was used to make each thermocouple. The thermocouples were typically spherical in shape with a nominal diameter of 1/32 in. The thermocouples were flattened slightly and spot welded to the surface of the test plate. A Keithley Metrabyte MTherm-20 computer board was used to convert the thermocouple signals to digital readings. These readings were then sent to the PC. A break-down of the expected errors supplied by the manufacturer is given below:

Thermocouples: Omega Type K special

TC Error = ±2.0 °F(1.1 °C) or ±0.4%

Data Acquisition: Keithley Metrabyte MTherm-20

Cold Junction Compensation Error = ±0.9 °F (0.5 °C)

A/D Error = ±0.7 °F (0.4 °C)

Channel to Channel Gradient Error = ±1.3 °F (0.7 °C)

Before and after each test, the MTherm-20 boards were calibrated. The calibration was performed with an Analogic Digi-Cal II Model AN6520-8A-110 with a specified error of ±1.0 °F (0.6 °C). The combined data acquisition error was found to be ±4.9 °F (2.7 °C). Therefore, the total expected error is as follows: total Expected Error = 6.9 °F or ±(0.004 x Reading + 4.9) °F whichever is greater.

Table 5.

Thermocouple Locations

TC	Location (in.) X ±0.04	Y ±0.04	Z ±0.001	Measurement Accuracy (±°F)
T1	0.25	-4.25	-0.0625	6.9 or 0.004 x Reading + 4.9
T2	0.25	-3.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T3	0.25	-2.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T4	0.25	-1.50	-0.0625	6.9 or 0.004 x Reading + 4.9
T5	0.25	-1.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T6	0.25	-0.50	-0.0625	6.9 or 0.004 x Reading + 4.9
T7	0.25	-0.25	-0.0625	6.9 or 0.004 x Reading + 4.9
T8	-7.44	0.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T9	-5.63	0.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T10	-3.75	0.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T11	-1.88	0.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T12	0.25	0.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T13	1.88	0.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T14	3.75	0.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T15	5.63	0.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T16	7.44	0.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T17	0.25	0.25	-0.0625	6.9 or 0.004 x Reading + 4.9
T18	0.25	0.50	-0.0625	6.9 or 0.004 x Reading + 4.9
T19	0.25	1.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T20	0.25	1.50	-0.0625	6.9 or 0.004 x Reading + 4.9
T21	0.25	2.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T22	0.25	3.00	-0.0625	6.9 or 0.004 x Reading + 4.9
T23	-7.25	4.25	-0.0625	6.9 or 0.004 x Reading + 4.9
T24	3.50	4.25	-0.0625	6.9 or 0.004 x Reading + 4.9
T25	0.25	4.25	-0.0625	6.9 or 0.004 x Reading + 4.9
T26	3.56	4.25	-0.0625	6.9 or 0.004 x Reading + 4.9
T27	7.25	4.25	-0.0625	6.9 or 0.004 x Reading + 4.9
T28	0.25	-1.00	0.0625	6.9 or 0.004 x Reading + 4.9
T29	0.25	1.00	0.0625	6.9 or 0.004 x Reading + 4.9

LVDT locations are given in Table 6 and are shown in Fig. 16. The LVDTs are mounted vertically on an 3/8 in. thick aluminum support plate directly under the test plate. The deflection of the LVDT mounting plate was found to be less than 0.0005 in. throughout the test series. The

Table 6.

LVDT Locations

LVDT	Location (in.) X ±0.06	Y ±0.06	Z ±0.001	Measurement Accuracy (±in.)
L1	-3.50	-4.00	-0.0625	+0.000374
L2	0.00	-4.00	-0.0625	+0.000374
L3	3.50	-4.00	-0.0625	+0.000374
L4	0.00	-2.00	-0.0625	+0.00150
L5	-6.00	0.00	-0.0625	+0.000374
L6	-3.50	0.00	-0.0625	+0.00150
L7	-2.00	0.00	-0.0625	+0.00150
L8	0.00	0.00	-0.0625	+0.00150
L9	2.00	0.00	-0.0625	+0.00150
L10	3.50	0.00	-0.0625	+0.000748
L11	6.00	0.00	-0.0625	+0.000374
L12	0.00	2.00	-0.0625	+0.00150
L13	-3.50	4.00	-0.0625	+0.000374
L14	0.00	4.00	-0.0625	+0.000748
L15	3.50	4.00	-0.0625	+0.000374

LVDTs used were Schaevitz Series GCD-121 with a manufacture's estimated error of ±0.25% of full range (see Table 7). LVDT calibrations performed before and after the test series found that the expected errors to be within ±0.25% (of full range). A Hewlett Packard Model 6205C power supply was used to supply the excitation voltage to the LVDTs. The LVDT supply voltage was monitored throughout the test and was found to have a maximum drift of ±0.001 volts. The output signal from the LVDTs was processed by a Keithley Metrabyte data acquisition system consisting of a DAS-8 and an EXP-16 computer boards. The DAS-8 performs the A/D conversion, while the EXP-16 conditions the signal. The DAS-8 has a 12 Bit analog to digital converter with an estimated error of ±0.01% (of reading) plus +1 Bit. The EXP-16 with a gain setting of 0.5 has an expected error of ±0.015% (of reading). The overall displacement errors for the 3 sensor ranges used are as follows:

Table 7.

Estimated Displacement Errors for Schaevitz's LVDT

Schaevitz Model No.	Sensor Range (±in.)	Estimated Error (± in.)
GCD-121-125	0.125	0.000374
GCD-121-250	0.250	0.000748
GCD-121-500	0.500	0.00150

The estimated errors for the displacement measurements for the various LVDT locations are given in Table 6.

A Fluke 45 Dual Display Multimeter was used to measure voltage and current being supplied to the heat lamp. The voltage and current measurements were then used to calculate lamp power. The multimeter measured the voltage directly and used an AEMC Model SD601 Current Probe to measure the current. The multimeter performed the analog to digital conversion and sent the data to the PC via an RS-232 interface. The multimeter used the slow scan rate (2.5 reading per s) setting to increase accuracy.

The manufacturers estimated errors are:

Fluke 45 Display Multimeter

estimated voltage error = 0.2% (of reading) + 100 (digits)

Note: 100 digits = 0.01 A

estimated current error = 0.5% (of reading) + 100 (digits)

Note: 100 digits = 0.1 mV

AEMC Model SD601 Current Probe

estimated error = 0.5% (of reading)

The above errors can be used to estimate the overall accuracy of the power calculations. Table 8 gives the power measurements with associated tolerances for each of the tests.

Table 8.

Power Measurements for Tests

Test No.	Output (%)	Average Power (Watts)		Average Power (Btu/s)	
1	5	184.5	± 2.2	0.1749	±0.0021
2	15	675.5	±11.1	0.6403	±0.0105
3	25	677.6	±11.1	0.6423	±0.0105
4	30	1625.8	±20.7	1.5410	±0.0196
5	70	3908.0	±41.0	3.7043	±0.0389

A photograph, Fig. 17, shows the test setup with the quartz lamp, chill-water piping, plate support system, and instrumentation supported by a frame of aluminum beams. The test plate actually cannot be seen in the photograph; it is completely hidden by insulation and the test frame.

Results

Results from Tests 2 and 5 will be discussed; however, plots from all five tests along with tabular data are contained in Appendices B1 - B5.

Elastic Response - Test 2. Test 2 was run at a power level P = 15%, and the lamp was shut off when the maximum plate temperature reached 375°F to insure elastic behavior. Temperature distributions T(0.25, y, t) across the plate at selected times are presented in Fig. 18. Temperature histories of three points are presented in Fig. 19. The temperature distribution across the plate is symmetric indicating symmetrical heating and symmetrical thermal boundary conditions. Other data not shown indicate that there is only a small variation (<4%) of the temperature along the plate x axis. Thus, the temperature distribution is essentially one-dimensional varying only with y, and it is symmetric about the x axis. The "back-to-back" thermocouples recorded nearly

identical values indicating that the temperature gradient through the 1/8 in. plate thickness was typically less than 3°F or less than 1.5% of the mean temperature. The temperature histories show that the temperature at the center of the plate reaches a maximum of 375°F at about 300s and subsequently decays smoothly after heating ceases.

Corresponding displacement responses are presented in Figs. 20-22. Figures 20 and 21 show the deflection of the plate along the x and y axis, respectively. These results clearly show that the buckling behavior represents a global deformation with a "half-wave" shape in orthogonal directions. Peak deflection is about -0.075 in. or slightly more than one-half plate thickness. Displacement histories at three points across the plate centerline are shown in Fig. 22. The plate deflection response is quasi-static. The oscillations in the displacement histories during the cool-down period are associated with the instrumentation. Finally, the overall buckling behavior is indicated in Fig. 23 which shows the plate center temperature plotted versus the plate displacement.

Inelastic Response - Test 5. Test 3 and Test 4 induced small inelastic deformations so that Test 5 began with a slightly deformed plate. Test 5 subjected the plate to a significantly higher heat flux than previous tests. The temperature responses, Fig. 24, show that the maximum plate temperature rose to 1000°F in about 88s. From Fig. 25, the temperature distributions show that the heated region was confined to a relatively narrow band about the x axis for y = ±1.5 in. Outside of this band, temperatures are unchanged. The plate displacement distributions during the heating duration are shown in Figs. 26 and 27. A maximum deformation of 2.5 plate thicknesses occurred. Figure 26 shows the final deformation indicating a permanent bow along the x axis. The almost straight-line variation of the displacement with y shown in Fig. 27 suggests the occurrence of a highly local inelastic deformation in the heated region. Displacement histories at three points along the centerline are shown in Fig. 28. The significant permanent deformation induced by the high local heating is clearly evidenced during the cool-down phase. Points near the center of the plate return to a positive displacement, but points near the ends return to a negative

displacement indicating the permanent bowing of the plate. Lastly, Fig. 29 presents the classical temperature-displacement response that occurs at the plate's center.

ISOTHERMAL TESTS

A series of isothermal elastic tests of a plate with a concentrated load at the center is described. The tests provide insight into the plate's mechanical boundary conditions. The tests load-deflection results are useful for validation of a finite element model's capability for prediction of the plate's load-deflection behavior for plate deflections up to about three plate thicknesses.

Test Description

The isothermal test series was initiated to examine possible sources for experimental errors in the thermal buckling tests. The three major areas examined were point support torques, LVDT effects, and cooling circuit effects. The tests used the test fixture from the thermal buckling tests with the heat lamp being replaced by a dead weight point loading device. The test fixture is described schematically in Fig. 30 . A photograph, Fig. 31 shows the test setup with the loading pallet, weights, and instrumentation. The test plate cannot be seen in the photograph; it is hidden by the test frame. The 15 in. x 10 in. x 1/8 in. Hastelloy-X plate is supported at four points and is loaded at the center with a concentrated load normal to the plate. The load is applied to the test plate through an 1 in. diameter spherical contact. As in the thermal buckling tests, to prevent in-plane motion one support uses a cone-shaped point set in a small indentation in the plate. At the other three points, 1/4 in. diameter spherical contacts are utilized as in the buckling tests. The dimensions of the test plate, the support locations coordinate system and other details are shown in Fig. 32.

Test Procedures

The 15 in. x 10 in. x 1/8 in. Hastelloy-X test plate was taken from the lot of nine plates purchased from ATEK as described previously. The plate was found to have a thickness ranging from 0.1232 in. to 0.1278 in. with an average thickness of 0.1259 in. and a maximum Δz of 0.0218 in.

The tests were conducted at room temperature. Typically in test sets 1 and 2, the plate

was placed in the test fixture resting on the lower point supports, but the upper point supports were not used. A test cycle consisted of loading the plate from 0 lbs to 274 lb and then back to 0 lbs in 20 lb increments. Displacement measurements were taken at each incremental load step. The loading was accomplished by adding 20 lb weights to the loading pallet. The weights were centered on the loading pallet, and then the loading pallet was rotated back and forth about the z axis for each loading step. This was to assure that the loading ram was not sticking to the bronze bushing. Several loading cycles were performed to examine different test conditions. The conditions examined are listed in Table 9.

Table 9.

Isothermal Tests

Test Set	Condition Description	Cycles Performed
1	Using a Laser Sensor to Measure Displacement	5
2	Using an LVDT Sensor to Measure Displacement	4
3	1/2 in-lb Torque on Point Supports	3
4	1 in-lb Torque on Point Supports	4
5	3 in-lb Torque on Point Supports	1
6	Finger Tight (4-5 in-lb of Torque) Point Supports	4
7	16 Fully Engaged LVDT Loading	2
8	Polybutelene Cooling Tubes	3
9	Plate with Cooling Tubes Hooked to Piping	2

The test procedure for the laser or LVDT sensor conditions (test sets 1-2) is that which has been previously described. The only difference between the two sets of tests is the sensor used to measure displacement. Several loading cycles were used for each set of tests.

The point-support torque tests (test sets 3-6) were designed to determine the sensitivity of the plate deflection to variations in the clamping torque applied to the point supports. The procedures for these test sets was the same as test sets 1 and 2 except the plate was clamped between the lower and upper point supports. The supports are 3/8-24 UNF socket head cap screws with either a cone or spherical end. The point supports were torqued down onto the plate with either a Snap-On 0 to 3

in-lb (resolution of 1 in-ounce) or 0 to 200 in-lb (resolution of 5 in-lb) torque meter. In the thermal buckling tests, the point supports were finger-tight. Finger-tight was found to be approximately 4 to 5 in-lbs of torque. Several loading cycles were performed for each of the point support torque conditions in test sets 3 - 6.

The setup procedure for the 16 fully engaged LVDT condition (test set 7) was as follows. A 274 lb load was applied to the plate without the upper point supports being used. Then 16 LVDTs were mounted below the plate on the LVDT mounting plate. The LVDTs were adjusted so that they would be fully engaged within their useful operating range. The 274 lb load was then removed. Two loading cycles were then performed.

The test set up for the plate with polybutylene cooling tubes (test set 8) was as follows. The edges of the plate were inserted and bonded in slots machined in the polybutylene tubes with a silicone- based RTV adhesive. The plate was then placed into the test fixture. A series of three loading cycles was then performed.

The setup procedure for the plate with cooling tubes hooked up to the piping (test set 9) condition was as follows. The upper supports were used to maintain the plates position up to the first load step, then they were disengaged from the plate. Two loading cycles were then performed.

Instrumentation

The plate was instrumented with either a laser or LVDT sensor to measure displacement at the plate center. The same PC base data acquisition system described previously. The laser displacement sensor used is a Keyence Model LB-70/LB-11. The laser sensor is a non-contact displacement measuring device; therefore, it does not transmit any load to the plate. A Hewlett Packard Model 6205C power supply was used to supply the excitation voltage to the laser sensor. The supply voltage was monitored throughout the test and was found to have a maximum drift of ±0.001 volts. The output signal from the LVDTs was processed by a Keithley Metrabyte data acquisition system consisting of DAS-8 and EXP-GP computer boards. The DAS-8 performs the A/D conversion, while the EXP-GP conditions the signal. Calibrations performed before and

midway through testing indicated that the overall combined accuracy of the sensor with data acquisition system to be ±0.002 in.

The LVDT was mounted vertically on an aluminum support plate directly under the test plate. The LVDT had a spring-loaded sensor probe which held it in contact with the plate. Therefore the sensor will apply a small load to the plate. The LVDT used was a Schaevitz Model GCD-121-250. (see previous Instrumentation Section for a description of errors) The LVDT was calibrated prior to the test series and was found to have an expected error within ±0.25% (of full range see Table 6). A Hewlett Packard Model 6205C power supply was used to supply the excitation voltage to the LVDTs. The LVDT supply voltage was monitored throughout the test and was found to have a maximum drift of ±0.001 volts. The output signal from the LVDTs was processed by a Keithley Metrabyte data acquisition system consisting of DAS-8 and EXP-16 computer boards. The DAS-8 performs the A/D conversion, while the EXP-16 conditions the signal. The DAS-8 has a 12 Bit analog to digital converter with an estimated error of ±0.01% (of reading) plus ±1 Bit. The EXP-16 with a gain setting of 0.5 has an expected error of ±0.015% (of reading). The overall expected displacement error for the LVDT was ±0.000748 in.

Dial indicators were used to monitor the deflection of the point support beams. The dial indicators were placed on the lower point support screw heads and at the beam centers. The dial indicators used were Starrett Model 25-631J with a resolution of 0.0005 in. The maximum support beam deflection observed throughout the test series was 0.007 in. The dial indicator displacement readings were averaged to obtain an average support deflection. The average support deflection was subtracted from the center displacement sensor reading to determine the plate's center deflection.

<u>Test Results</u>

There was no significant difference between measurements made with the laser and the LVDT. The results for these two conditions were combined, and a linear regression analysis was performed on the data. The analysis indicated that the displacement-load relationship was

linear, and the displacement can be estimated with the following expression,

$$w_{cr}(\text{in.}) = \text{Load (lb)} \times 1.255\text{E-3 in./lb} \tag{4}$$

This will be called the control regression and all the various conditions will be compared to it. The results show that for the test plate with point supports, the center deflection is linearly related to the load for deflections up to 0.34 in. or 2.7 plate thicknesses. The linearity of the behavior is interesting because standard textbooks describing plate theory (see, for example, reference 8) state that linear plate theory becomes inaccurate for deflections as large as the thickness of the plate.

Results for the laser and LVDT conditions along with the control regression are shown in Figures 33 and 34. These two figures show that the control regression curve fits both the laser and LVDT data very well. It can also be seen that there is very little difference between the deflection measurements taken with the two sensors. The regression results along with percent differences from the control regression for all the test conditions are given in Table 10.

Table 10

Isothermal Test Results

Test Set	Condition	Load Coef.	Standard Error Load Coef.	Standard Error w Est.	No. of Observations	Diff. of Load Coef. From Laser + LVDT
1	Laser Sensor	1.257E-03	1.040E-06	1.882E-03	133	0.139%
2	LVDT Sensor	1.253E-03	8.569E-07	1.423E-03	116	-0.165%
3	Laser + LVDT Sensor Data	1.255E-03	6.947E-07	1.706E-03	249	0.000%
3	1/2 in-lb Support Torq.	1.242E-03	1.368E-06	1.967E-03	87	-1.074%
4	1 in-lb Support Torq.	1.241E-03	1.194E-06	1.983E-03	116	-1.161%
5	3 in-lb Support Torq.	1.238E-03	3.094E-06	2.568E-03	29	-1.360%
6	Finger Tight (4-5 in-lb)	1.232E-03	5.629E-06	5.088E-03	105	-1.874%
7	16 LVDTs	1.240E-03	1.033E-06	1.213E-03	58	-1.176%
8	Polybutelene Tubes	1.242E-03	1.138E-06	1.637E-03	87	-1.032%
9	Coolant Piping	1.238E-03	1.709E-06	2.007E-03	58	-1.325%

In the point support torque tests, the torque was varied from 1/2 in-lb to finger tight (4-5 in-lbs). Figures 35 - 38 plot these results along with the control regression for each of the conditions. In general it can be seen from Fig. 35 - 38 and Table 10 that the plate deflection

decreases, and the data variance increases as the support torques are increased. In the finger-tight condition, a little hysteresis can be seen in Figure 38. Figures 39 - 41 show results for the 16 LVDT, polybutelene, and coolant piping conditions. The effects from these conditions are small. (less than 2%)

The results from this test series does not reveal any serious problems with the test setup or procedure for the thermal buckling test series. Nevertheless, the results point out areas were care should be taken. Such an area is the point support torques. It is apparent from the test results that over-tightening of point supports can affect test results adversely. For future plate tests, the supports should be tightened to 1/2 - 1 in-lb. Care should also be taken with coolant line connections not to restrict plate's movement.

CONCLUDING REMARKS

An experimental investigation of plate buckling induced by spatial temperature gradients is described. Rectangular plates are heated transiently by a quartz heat lamp focused on the plate centerline. Parallel edges of the plate are maintained at constant temperature by chill water flow through coolant tubes. The plate is supported at only four points to provide well-defined thermal and structural boundary conditions. A heat lamp characterization study is described, and an empirical formula for the incident surface heat flux is developed. The thermal buckling test procedure is described, and results from five tests are presented. A series of isothermal tests with a point load were conducted to investigate the test mechanical boundary conditions. These tests validated the test conditions. The tests also showed an interesting result: the plate load-deflection curve was linear up to nearly three plate thicknesses for the point supports employed.

Temperatures and displacement results for elastic and inelastic thermal buckling tests are presented. The plate exhibited a global buckling response in both tests. In the inelastic test the plate maximum displacement exceeded two plate thicknesses and significant permanent deformation was induced.

The tests reaffirm that localized heating can cause substantial out-of-plane bending of real plates. The global bending deformations demonstrated were due to in-plane spatial temperature gradients and initial plate warpage. Small initial warpage with compressive membrane thermal forces was sufficient to initiate substantial transverse bending.

ACKNOWLEDGMENT

The research efforts of the authors are supported in part by the Aerothermal Loads Branch and the Aircraft Structures Branch at NASA Langley Research Center and the University of Virginia Academic Enhancement Program. We are most appreciative of the encouragement and technical support of our Langley technical monitors, Drs. Allan R. Wieting and James H. Starnes, Jr. Early work on the plate buckling tests at UVA was performed by Mr. Joseph G. Sikora of NASA Langley, and we are most appreciative of his efforts and continued support. We would also like to thank Mr. Travis L. Turner of Langley for his very helpful comments concerning the characterization of quartz heat lamps.

REFERENCES

1. Dechaumphai, P., Thornton, E. A., and Wieting, E. A., "Flow-Thermal-Structural Study of Aerodynamically Heated Leading Edges," Journal of Spacecraft and Rockets, Vol. 26, No. 4, July-August 1989, pp. 201-209.

2. Poleski, S. P., Dechaumphai, P., Glass, C. E., and Pandey, A. K., "Three-Dimensional Thermal-Structural Analysis of a Swept Cowl Leading Edge Subjected to Skewed Shock-Shock Interference Heating," J. of Thermophysics and Heat Transfer, Vol. 6, No. 1, Jan.-March 1992, pp. 48-54.

3. Thornton, E. A., Oden, J. T., Tworzydlo, W. W., and Youn, S. K., "Thermo-Viscoplastic Analysis of Hypersonic Structures Subjected to Severe Aerodynamic Heating," Journal of Aircraft, Vol. 27, No. 9, Sept. 1990, pp. 826-835.

4. Thornton, E.A., "Thermal Buckling of Plates and Shells," Applied Mechanics Reviews, Vol. 46, No. 10, October 1993, pp. 485-506.

5. R. R. Heldenfels and W. M. Roberts, "Experimental and Theoretical Determination of Thermal Stresses in a Flat Plate," NACA TN 2769, 1952.

6. Gossard, M. L., Seide, P., and Roberts, W. M., "Thermal Buckling of Plates," NACA TN 2771, 1952.

7. Teare, W. P., and Fields, R. A., "Buckling Analysis and Test Correlation of High Temperature Structural Panels," Thermal Structures and Materials for High Speed Flight, E. A. Thornton, ed., Progress in Astronautics and Aeronautics, AIAA, April 1992, pp. 337-352.

8. Fung, Y.C., Foundations of Solid Mechanics, Prentice-Hall, Englewood Cliffs, New Jersey, 1965, p. 463.

LIST OF FIGURES

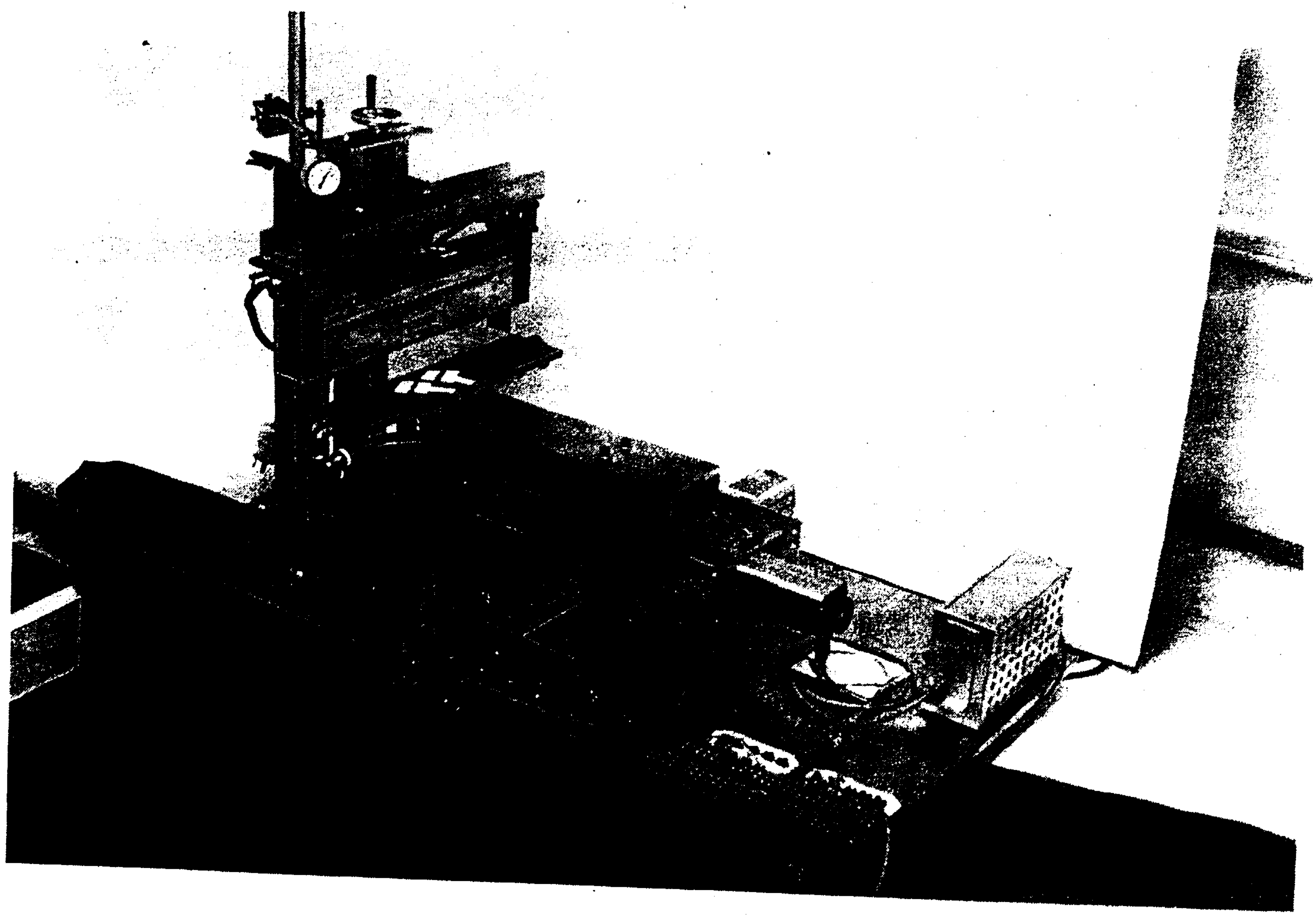


Figure 2. Photograph of lamp characterization test set-up.

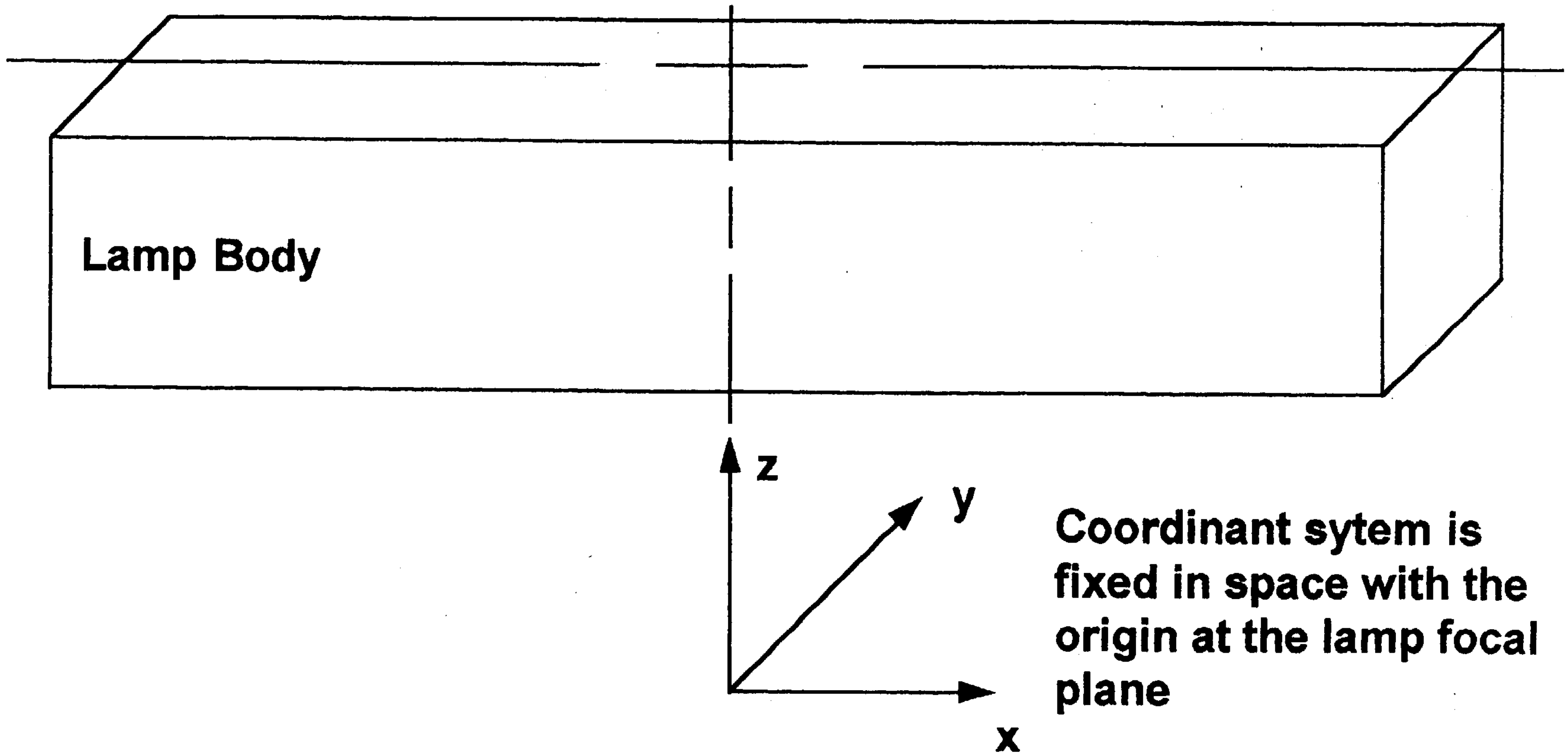


Figure 3. Coordinate system for lamp characterization tests.

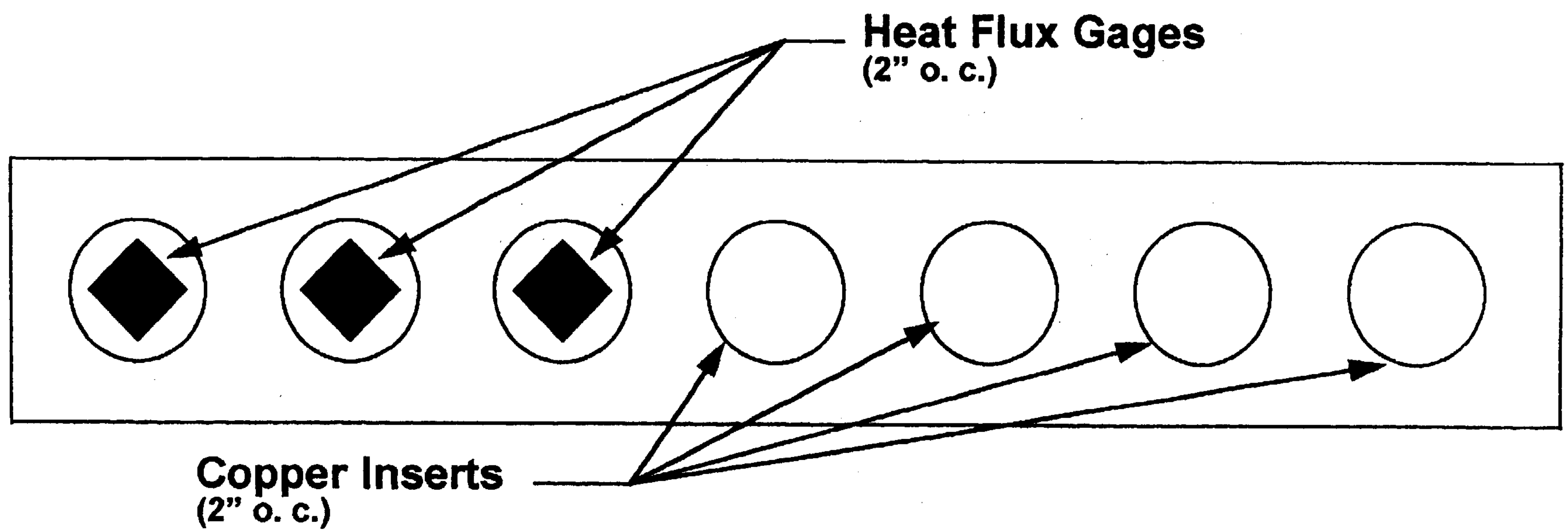


Figure 4. Heat flux gage layout.

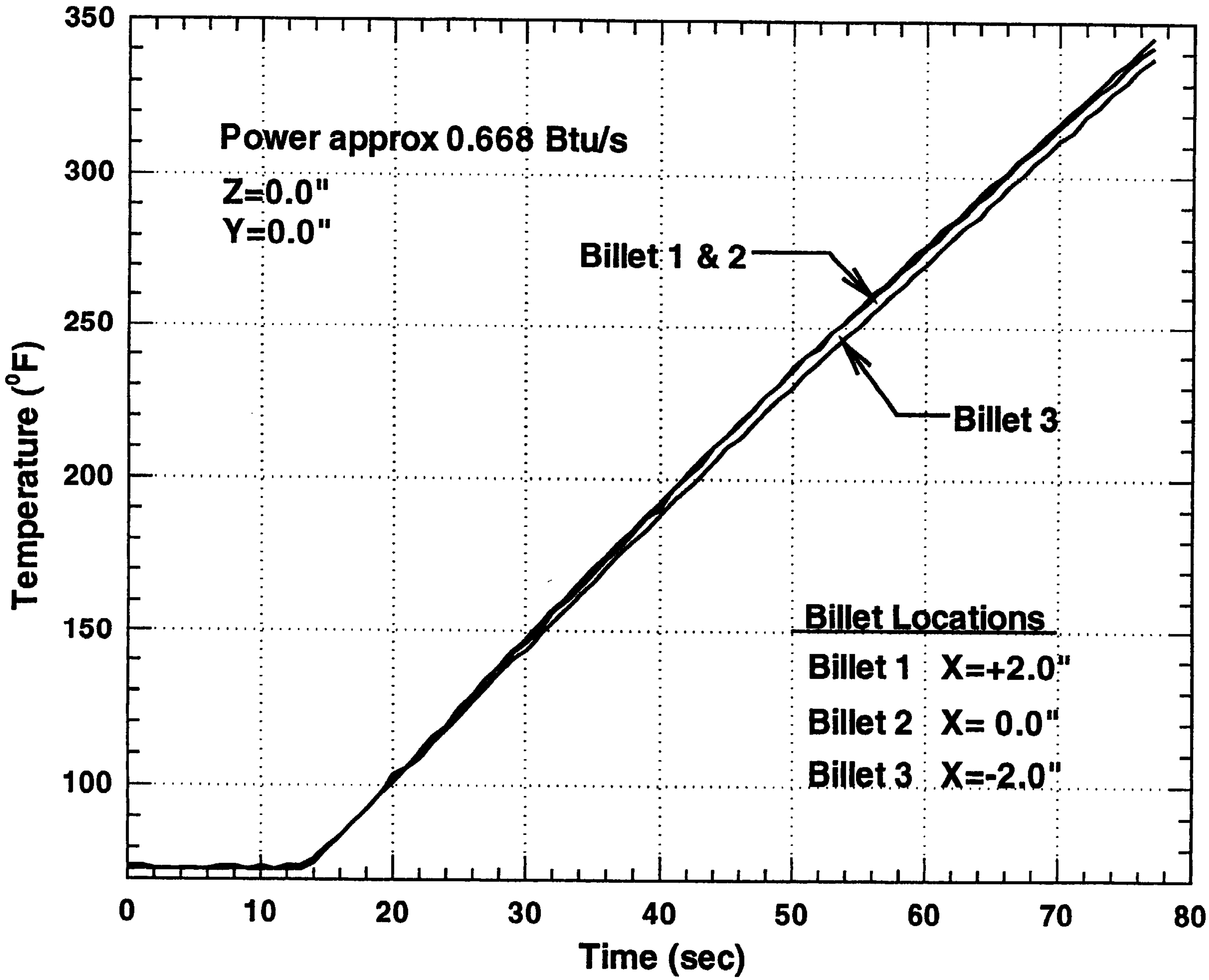


Figure 5. Results from typical billet test.

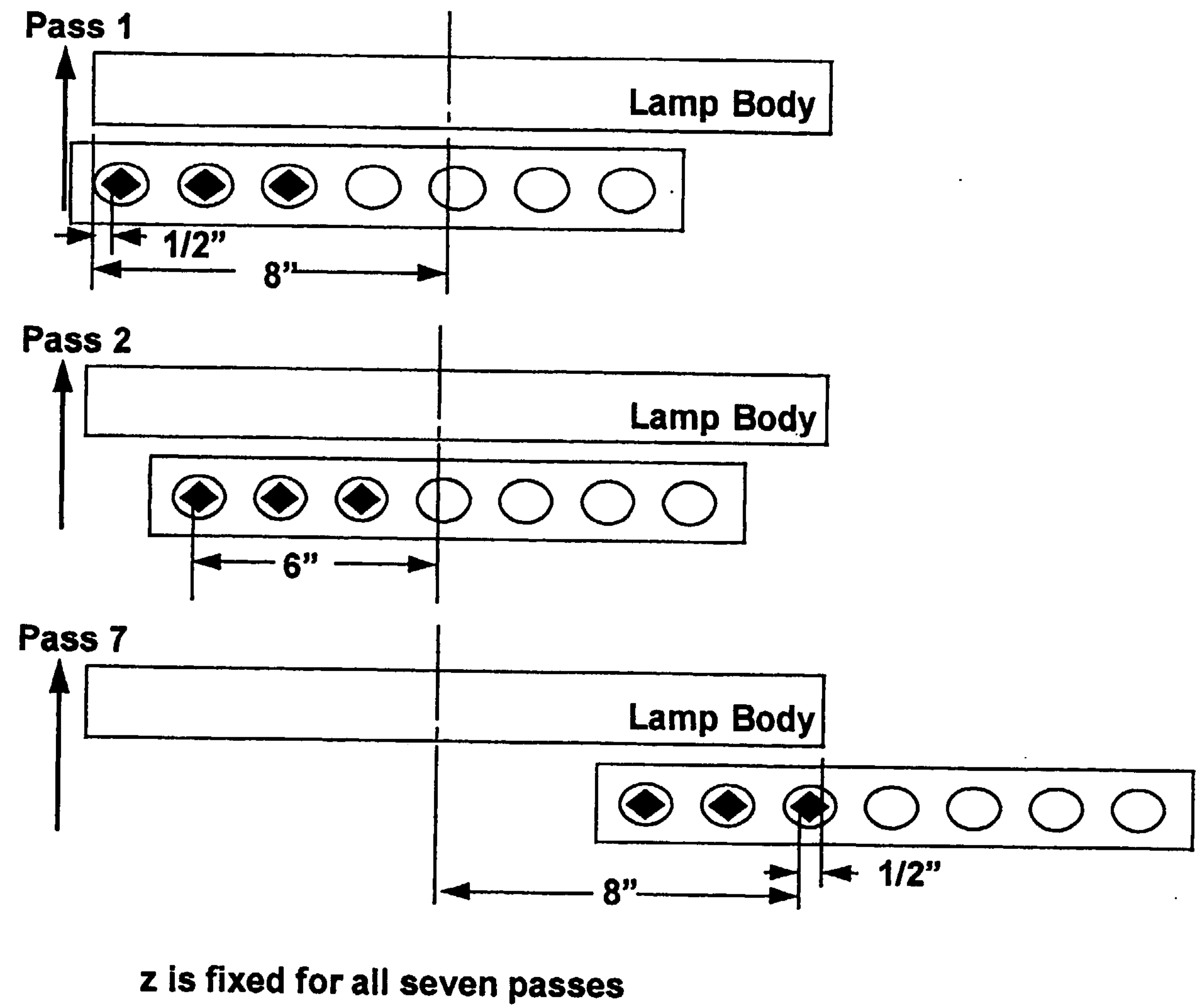


Figure 6. Heat flux gage position during test.

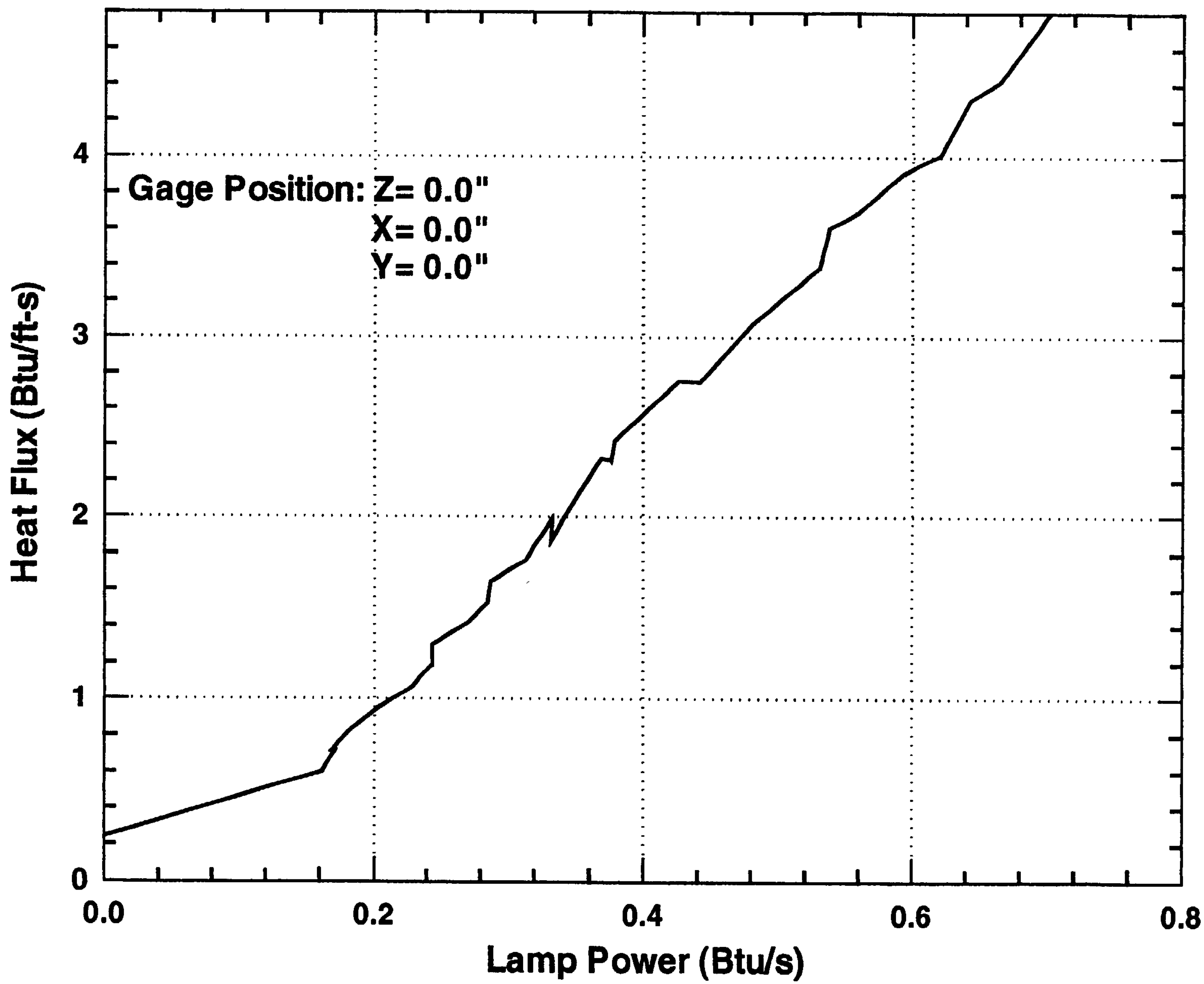


Figure 7(a) Heat flux vs. Lamp Power. 0<P<15%

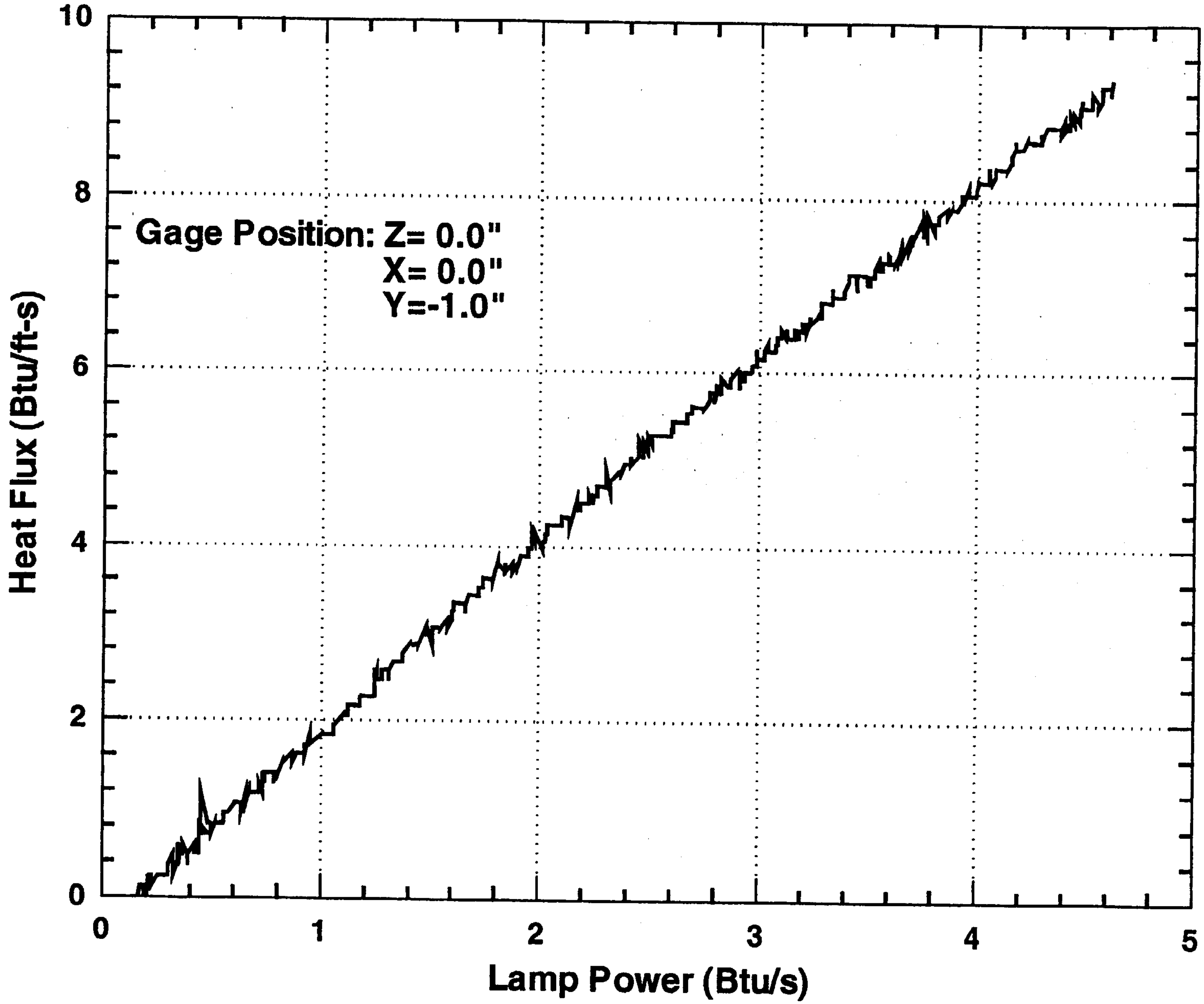


Figure 7(b) Heat flux vs. Lamp Power. 0<P<85%

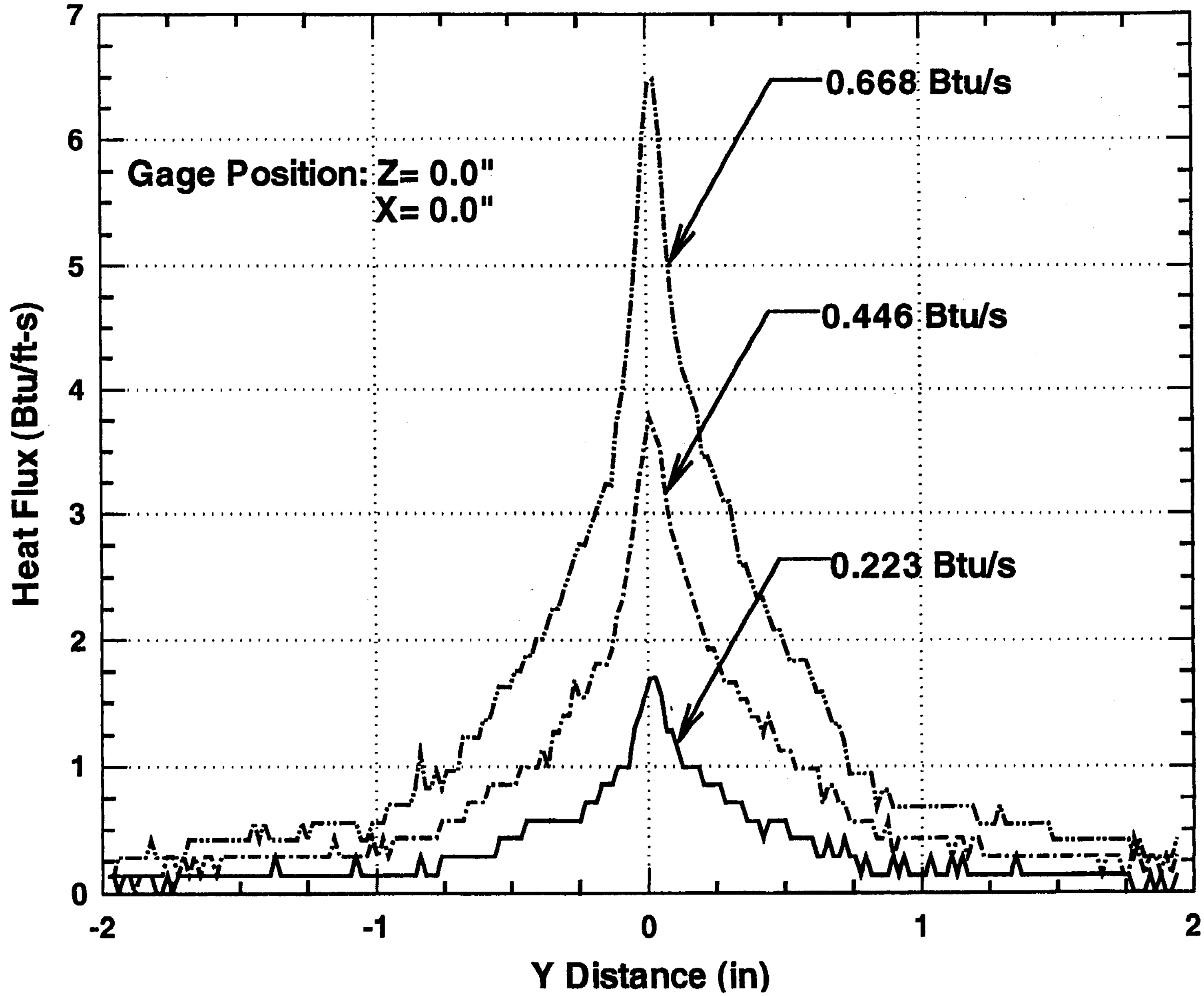


Figure 8. Heat flux y axis distribution.

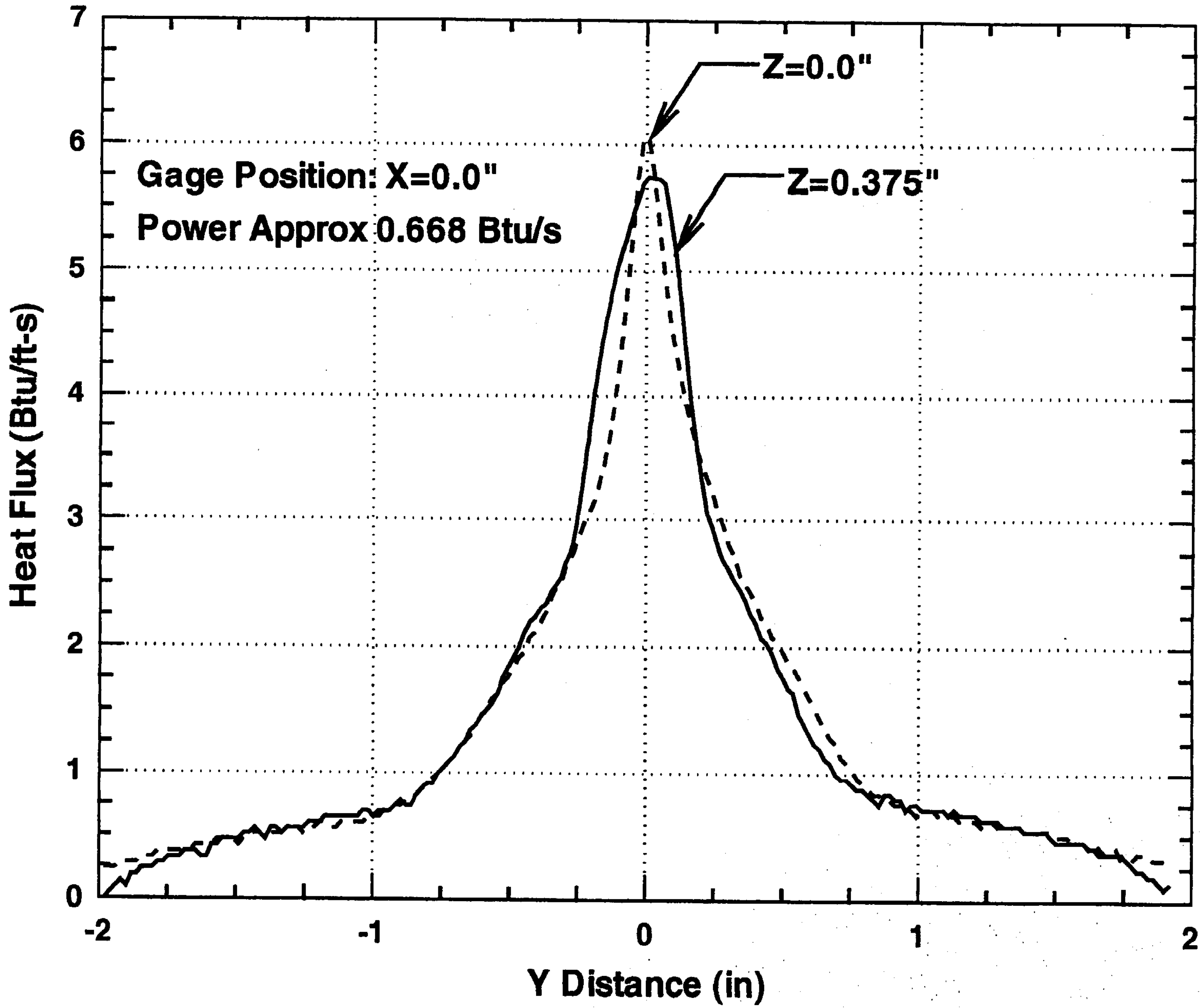


Figure 9. Heat flux y axis distribution, z=0 in.,0.375 in.

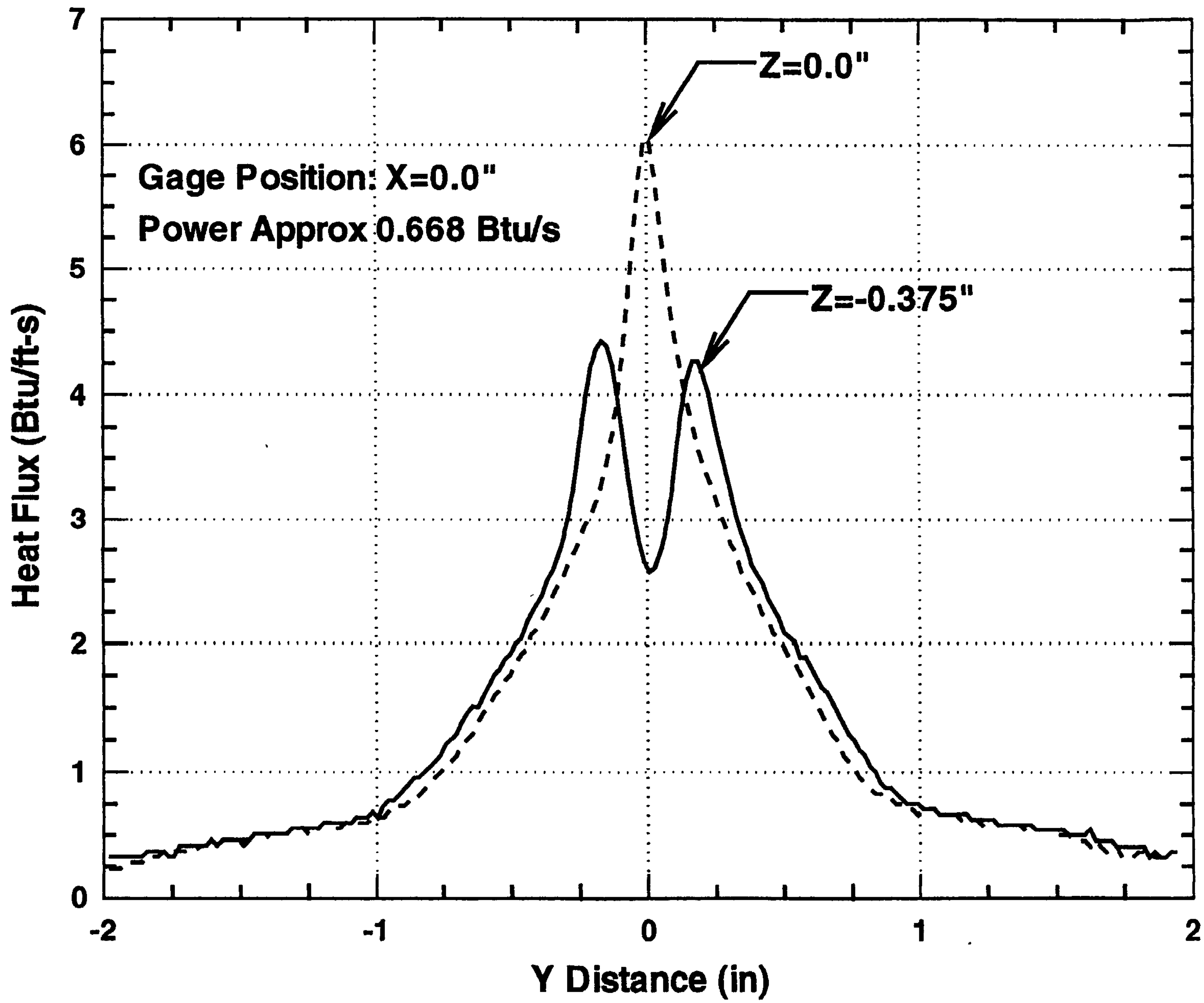


Figure 10. Heat flux y axis distribution, z=0 in.,-0.375 in.

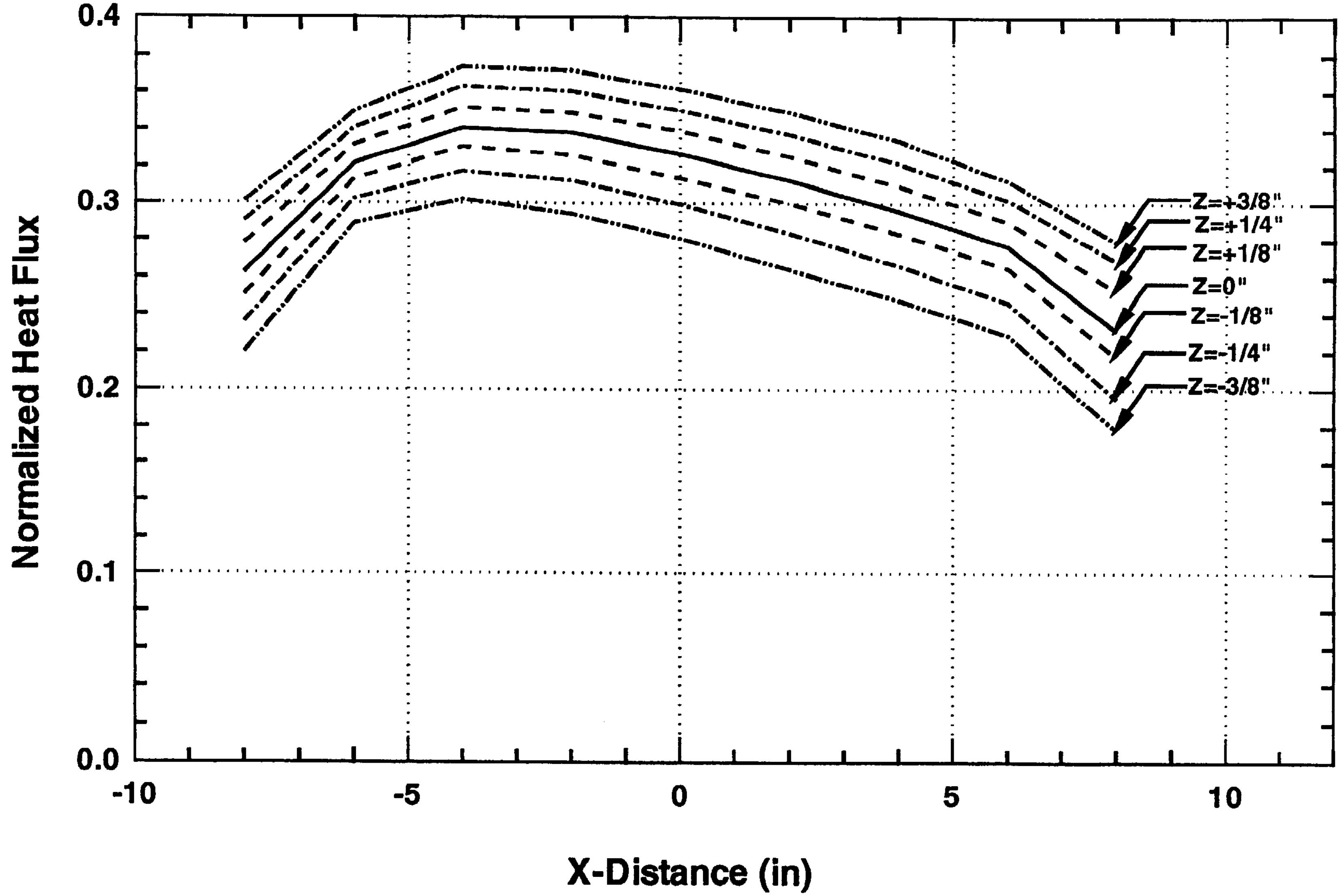


Figure 11. Normalized Heat Flux vs. x-Distance (with z dependence).

Panel Buckling Test Schematic

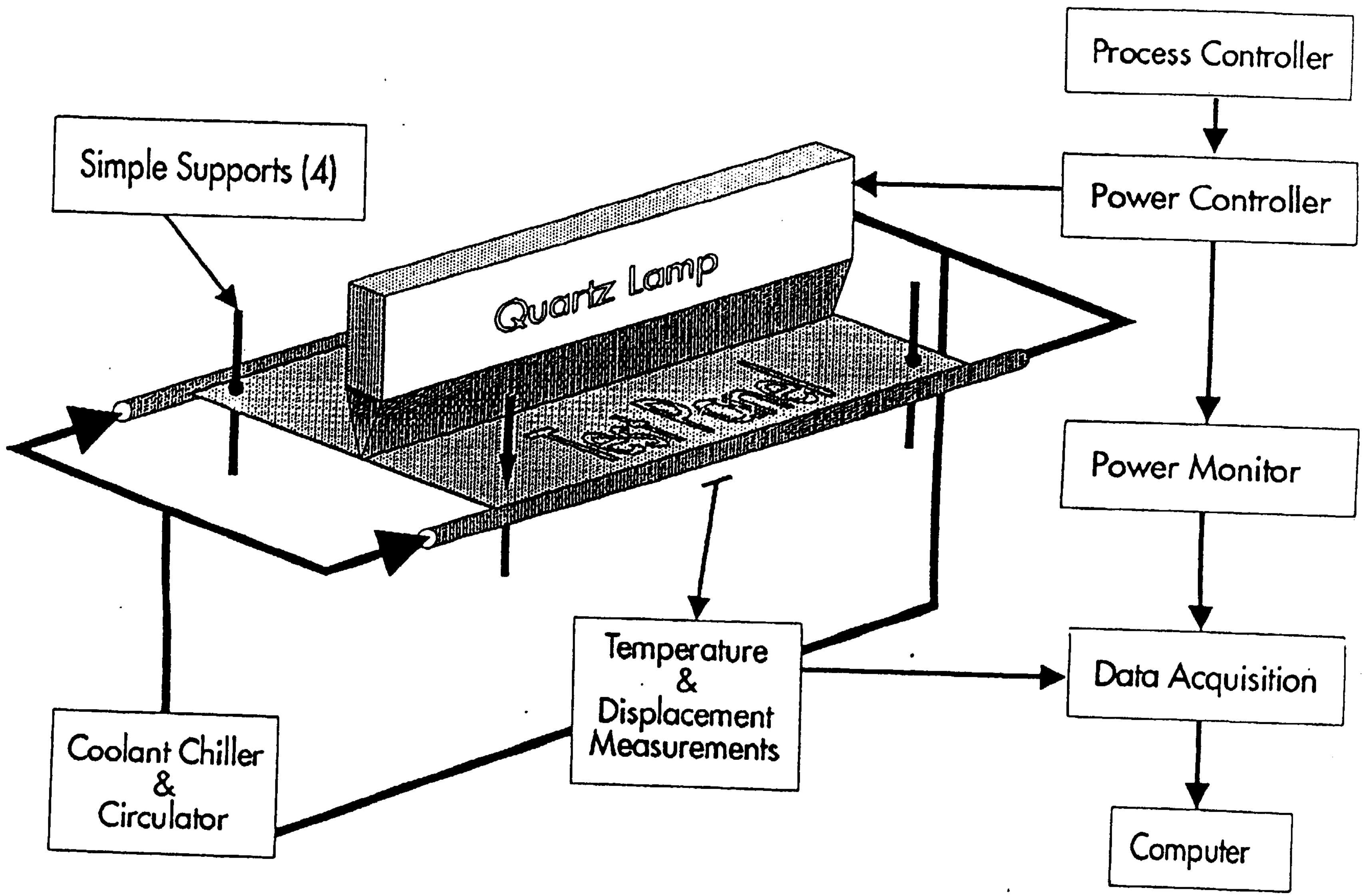


Figure 12. Schematic of text fixture for plate buckling tests.

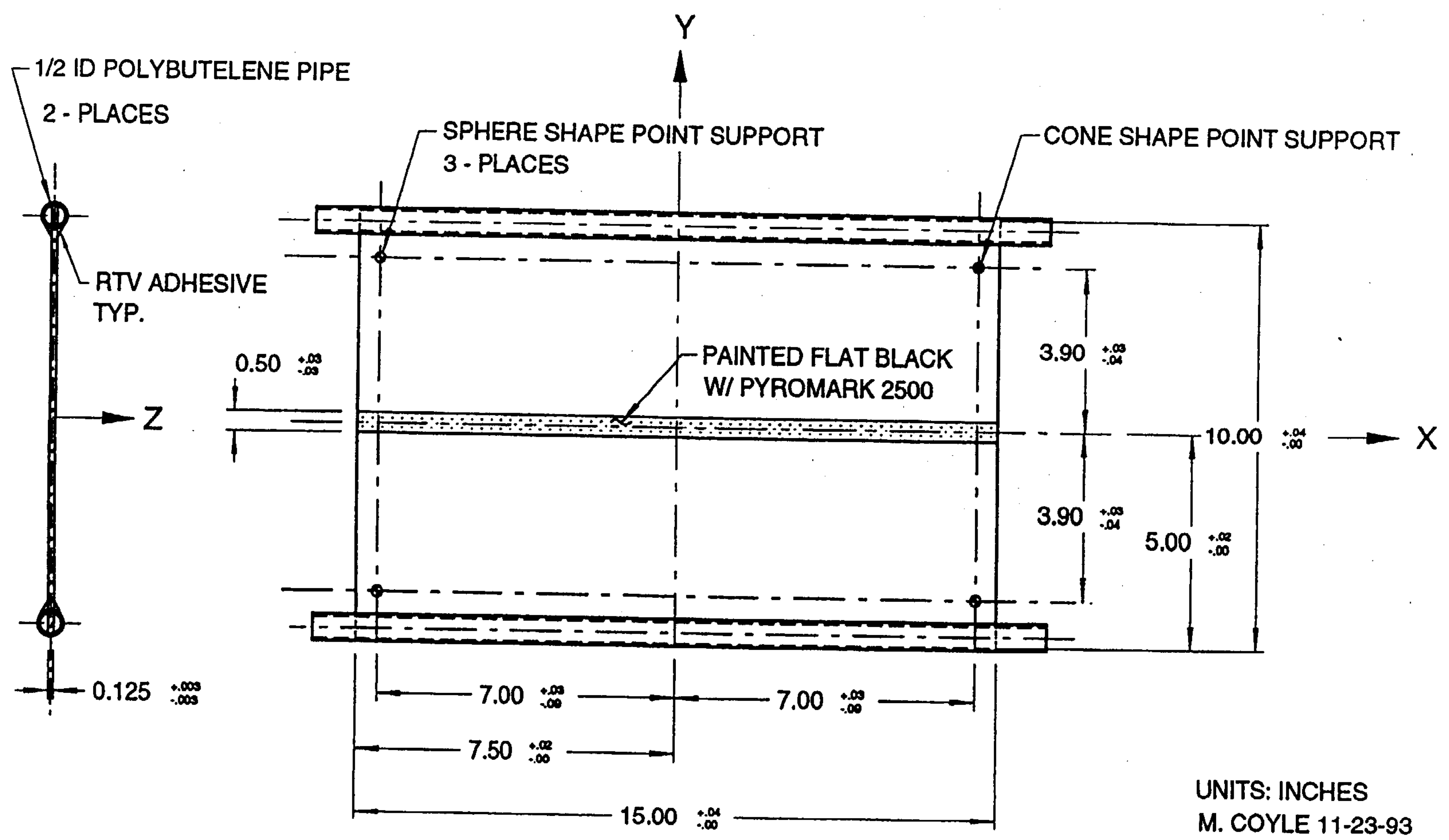


Figure 13. Plate dimensions and support locations.

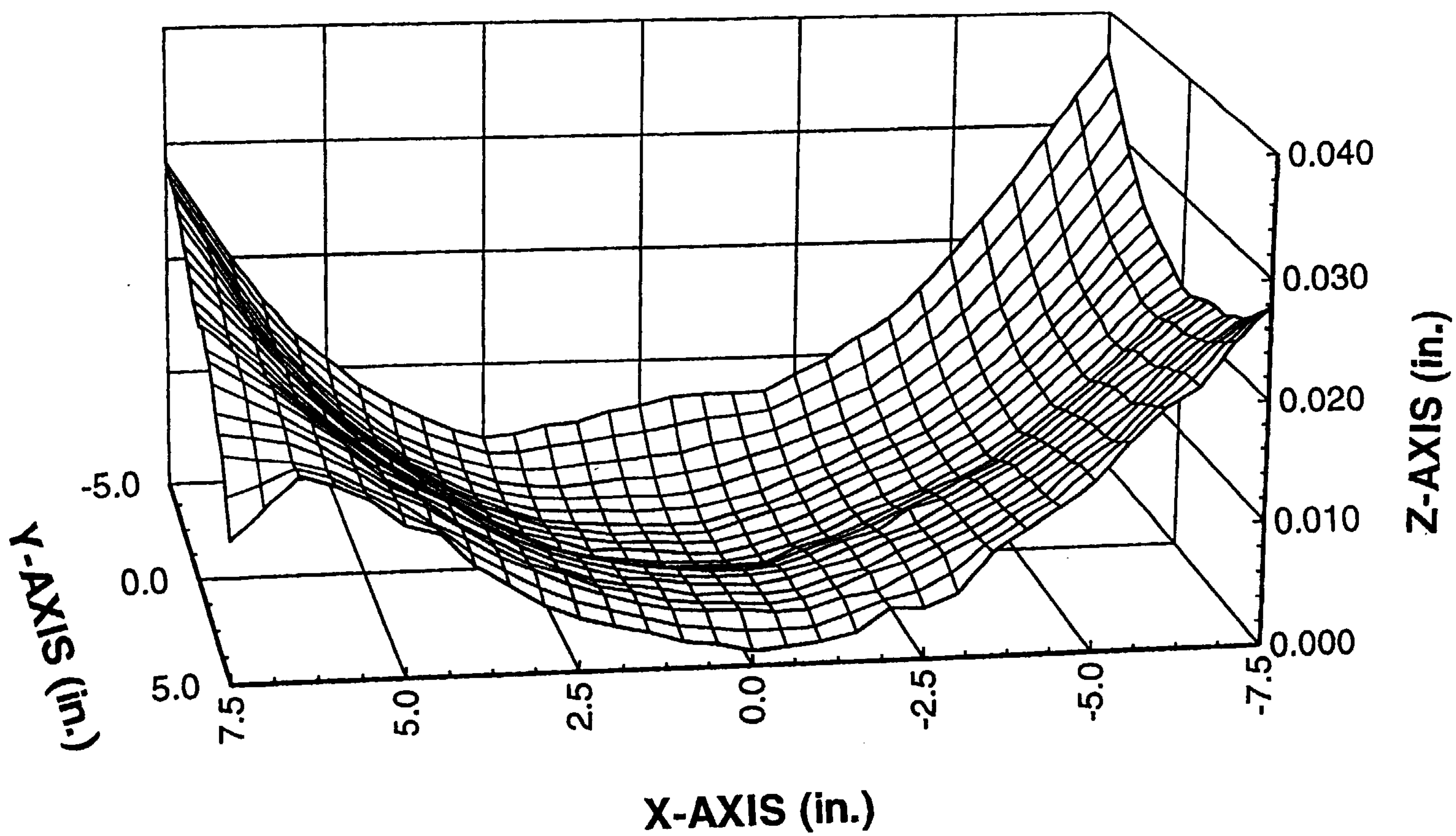


Figure 14. Initial transverse deflection of the test plate.

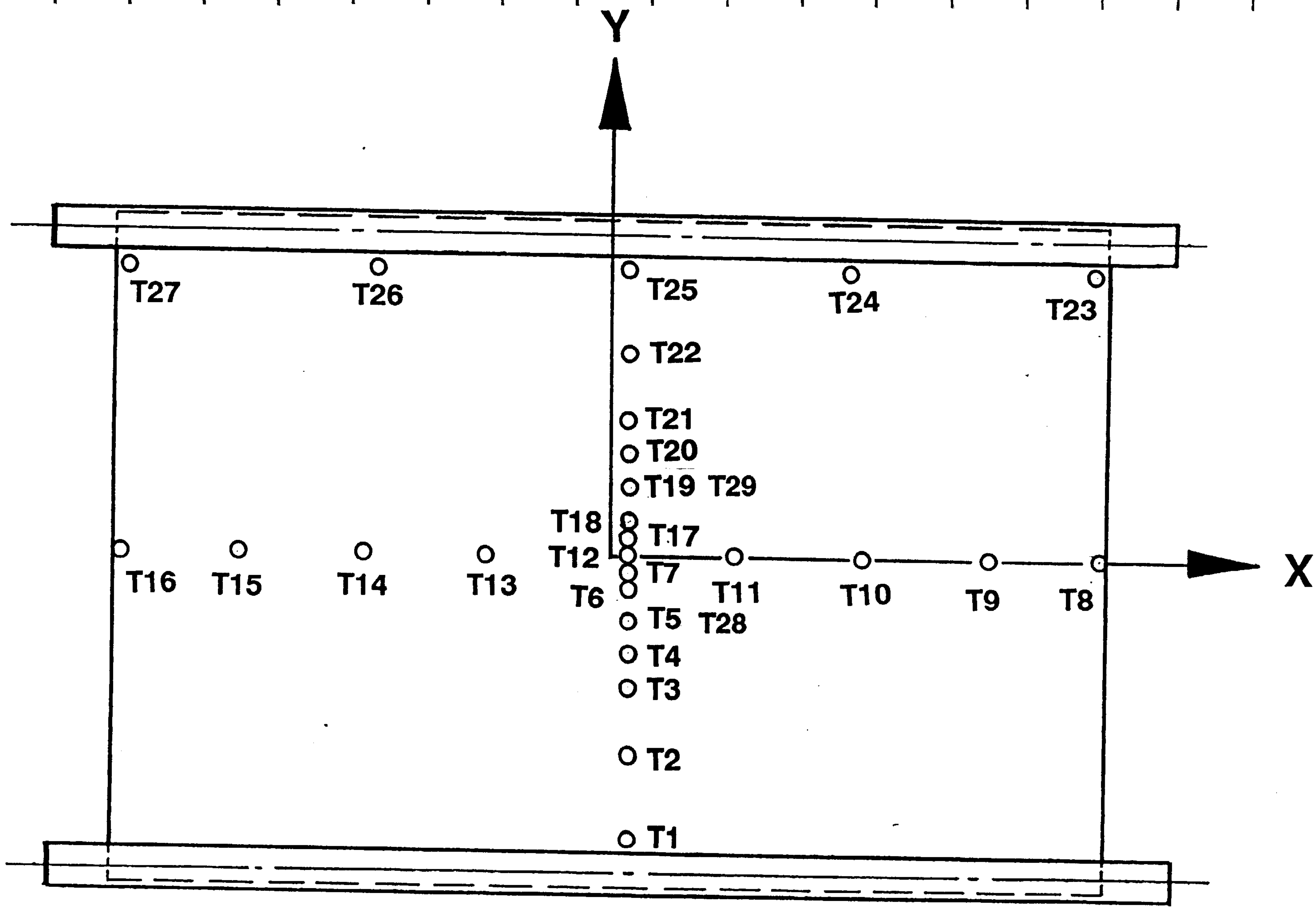


Figure 15. Thermocouple locations on test plate.

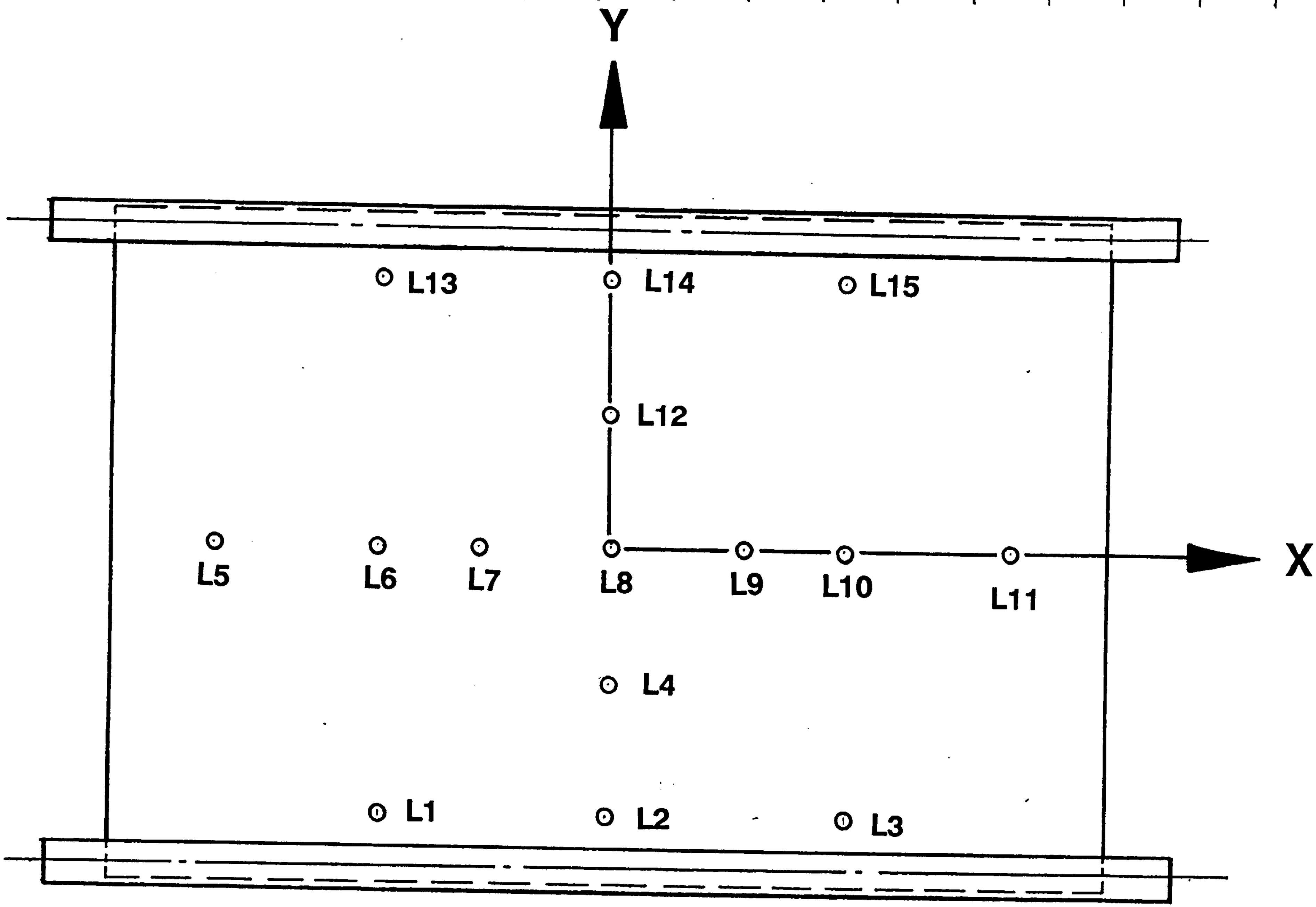


Figure 16. LVDT locations on test plate.

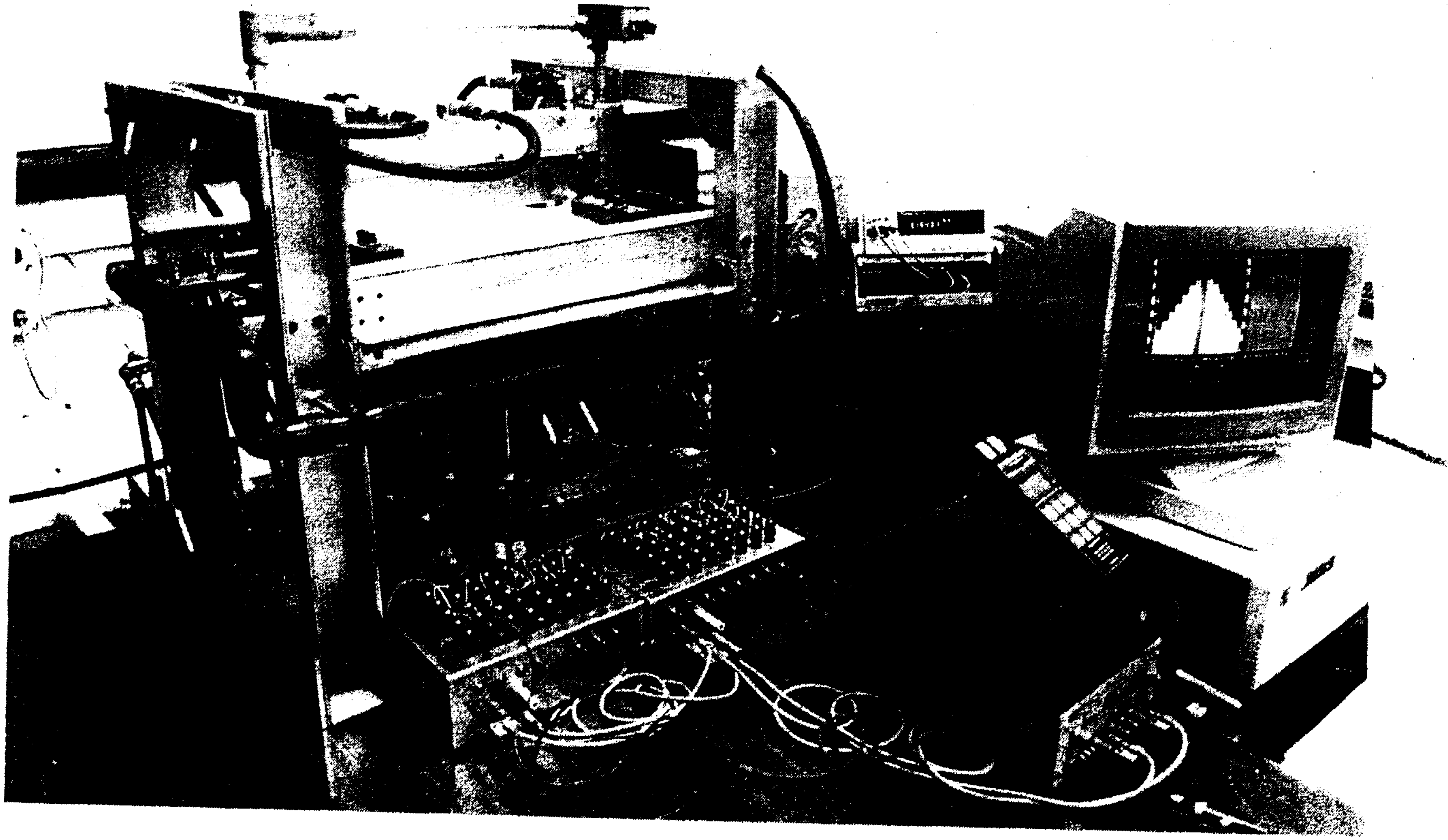


Figure 17.   Photograph of test fixture for plate buckling tests.

Figure 18. Plate temperature distributions, T(0.25,y,t), t=50,150,300s. Test 2.

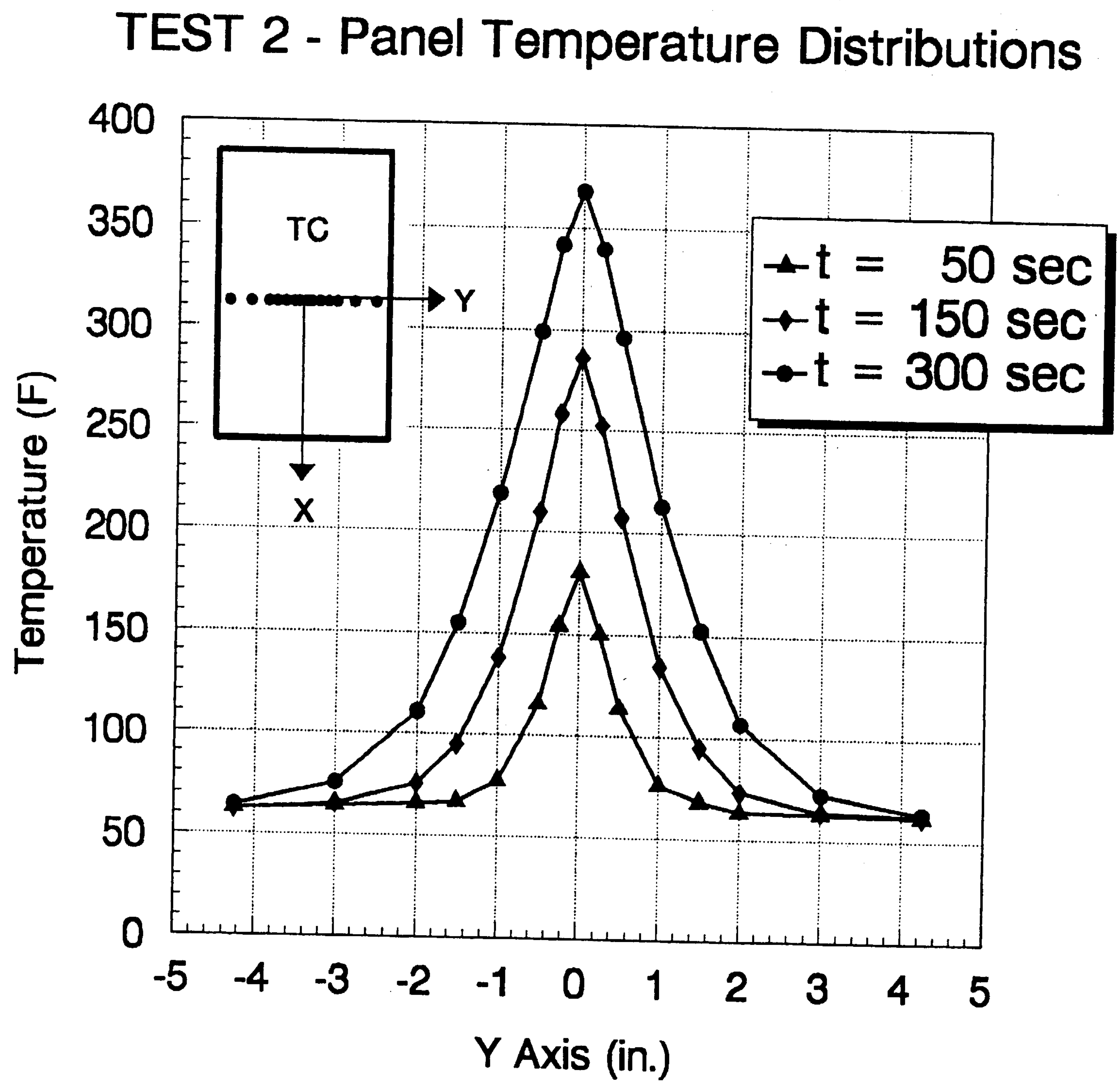


Figure 19. Plate temperature histories, $T(0.25,y,t)$, $y=0,-1,-2$ in. Test 2.

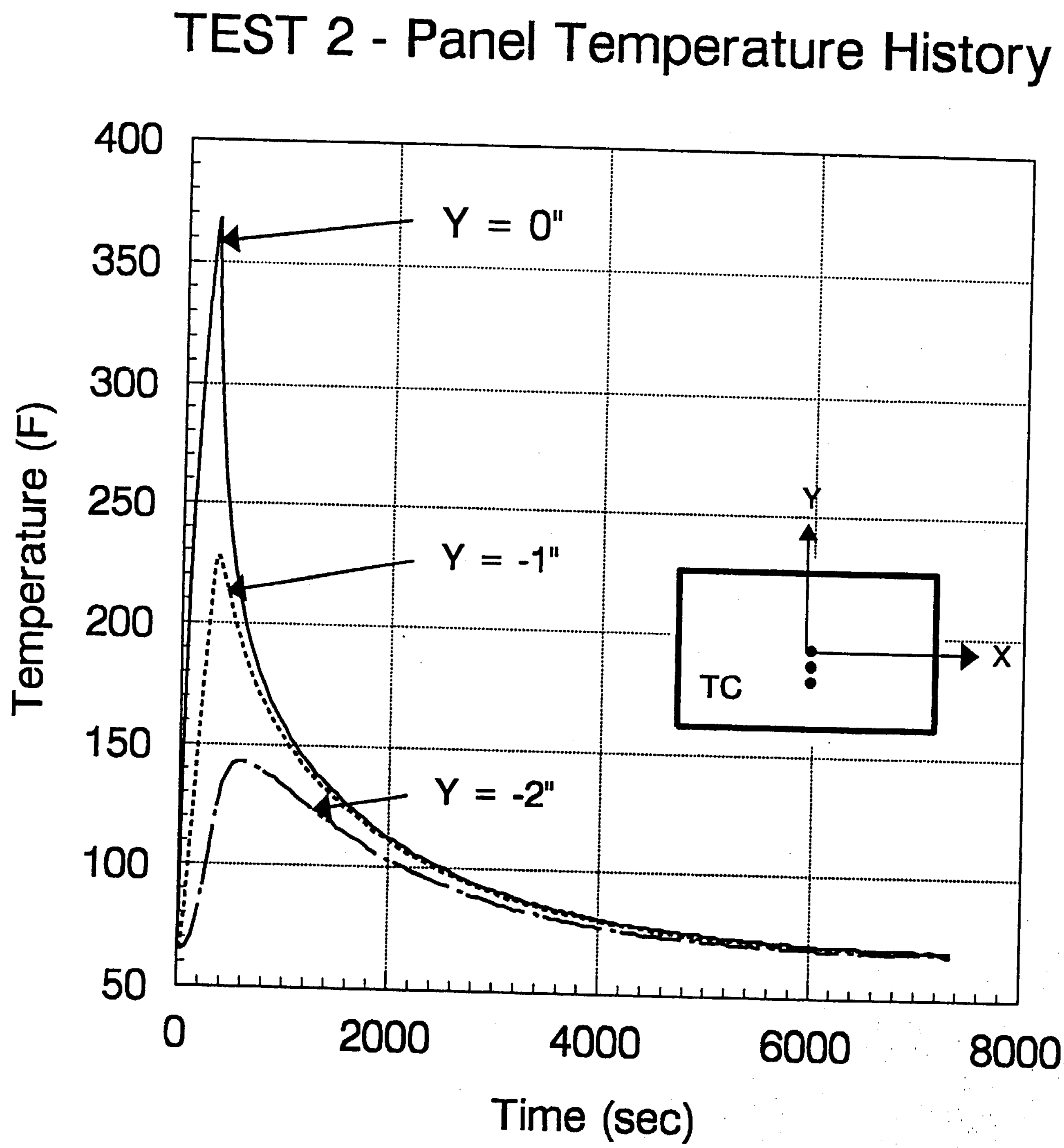


Figure 20. Plate displacement distributions, $w(x,0,t)$, $t=0,150,300s$. Test 2.

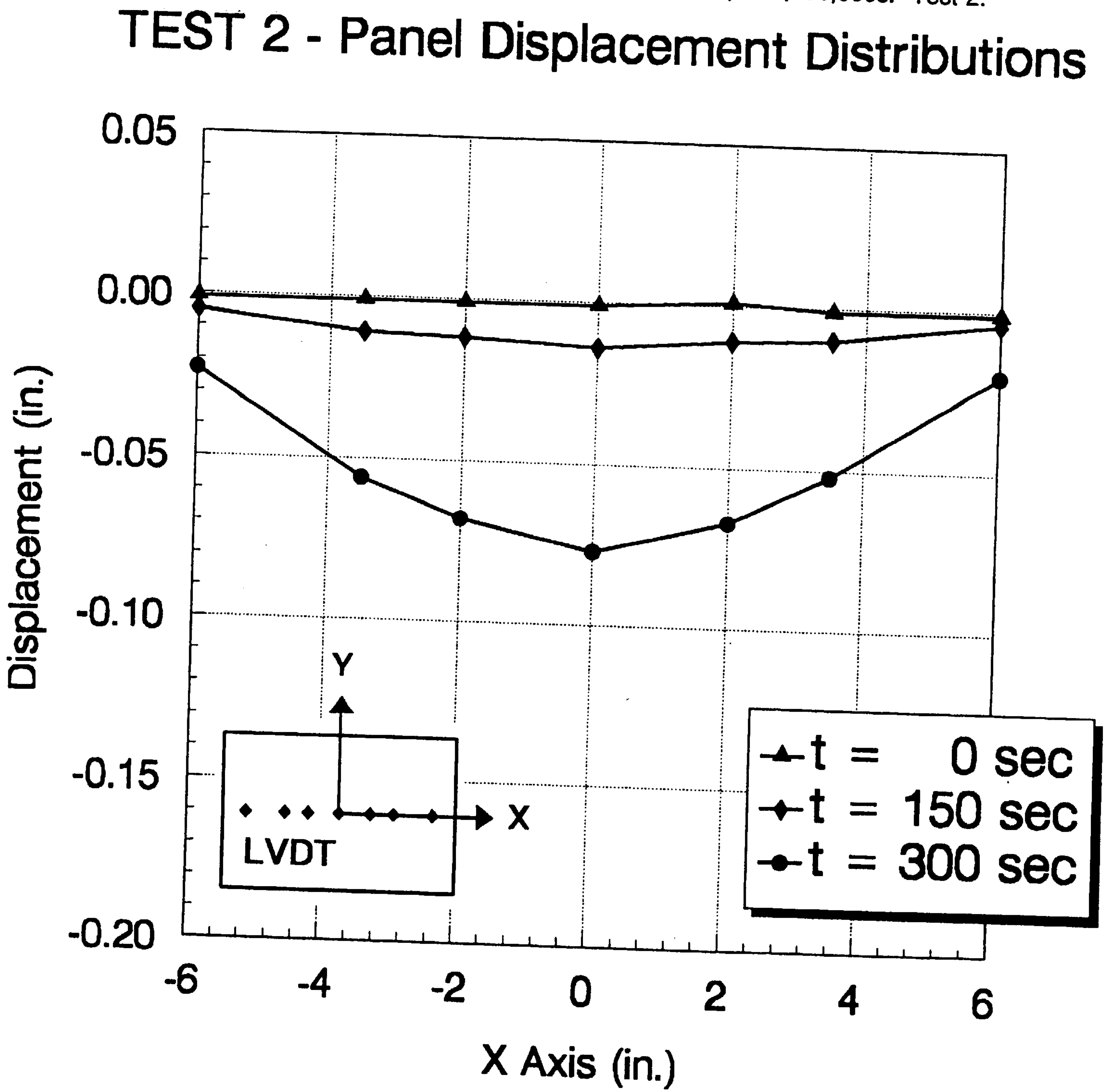
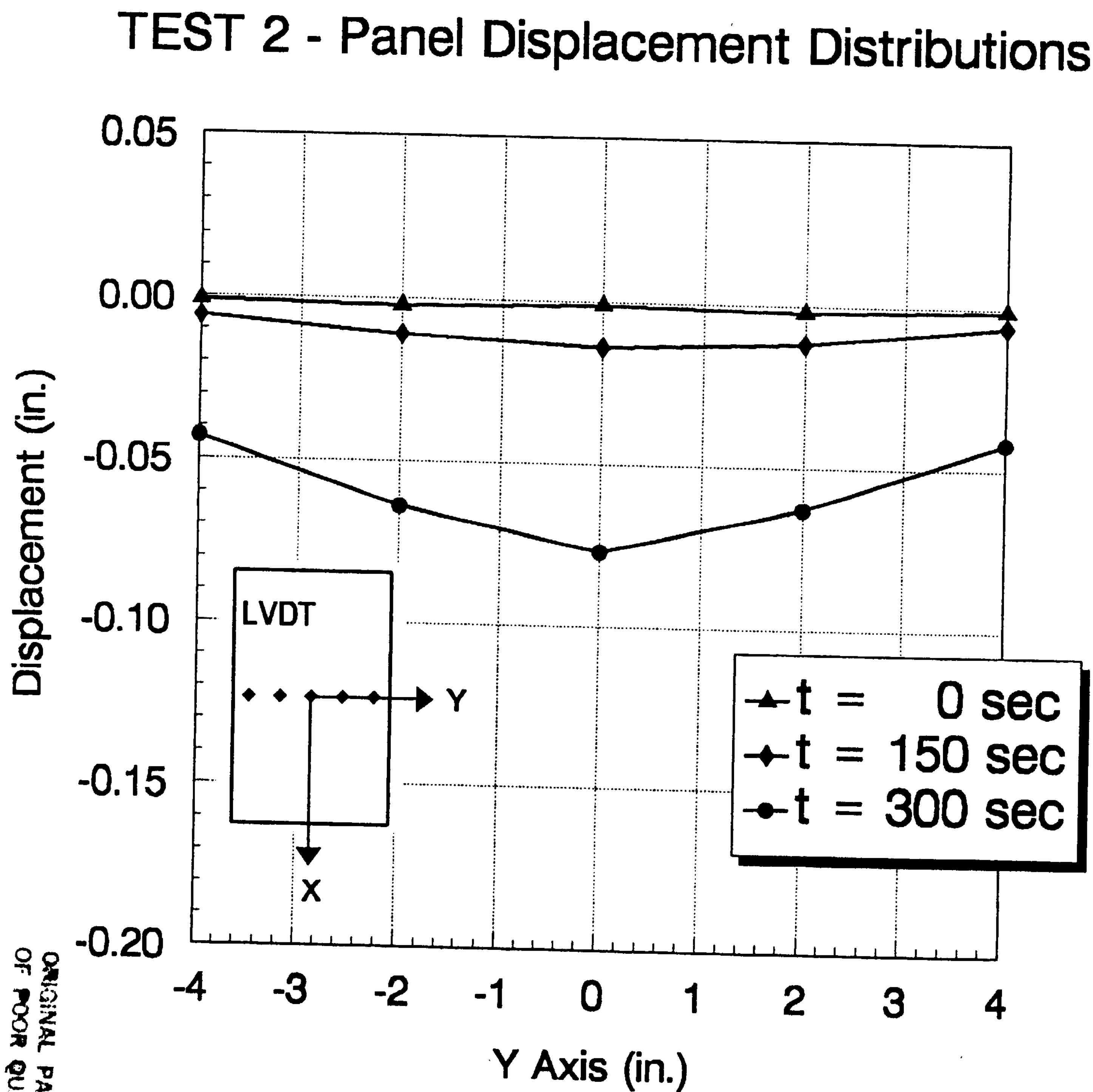
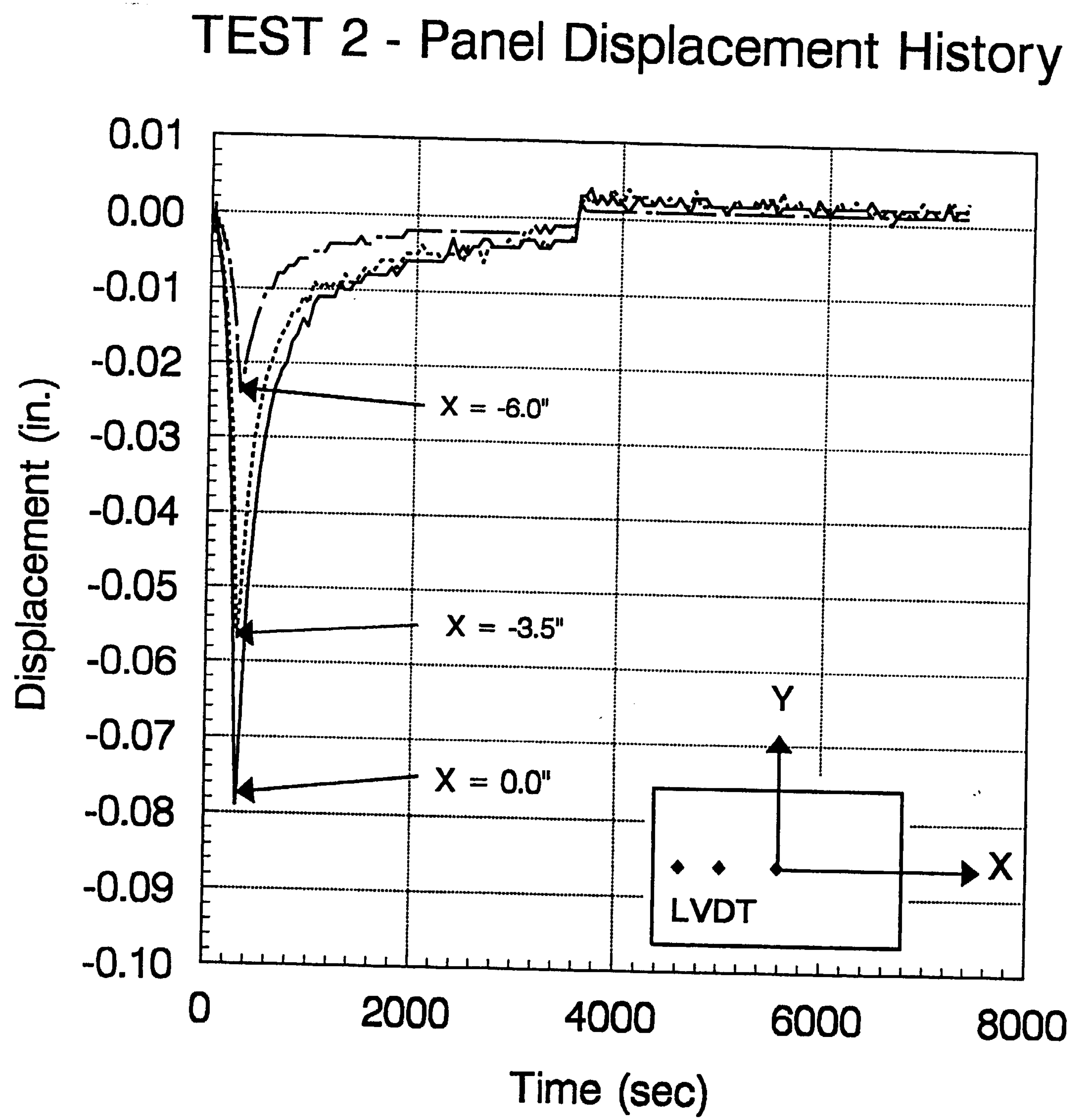


Fig. 21. [illegible] lated displacement distributions, w(0,y,t), t=0,150,300s. Test 2.



ORIGINAL PAGE IS
OF POOR QUALITY

Figure 22. Plate displacement history, w(x,0,t), x=0,-3.5,-6. in., Test 2.



TEST 2 - Panel Center Temperature Versus Displacement

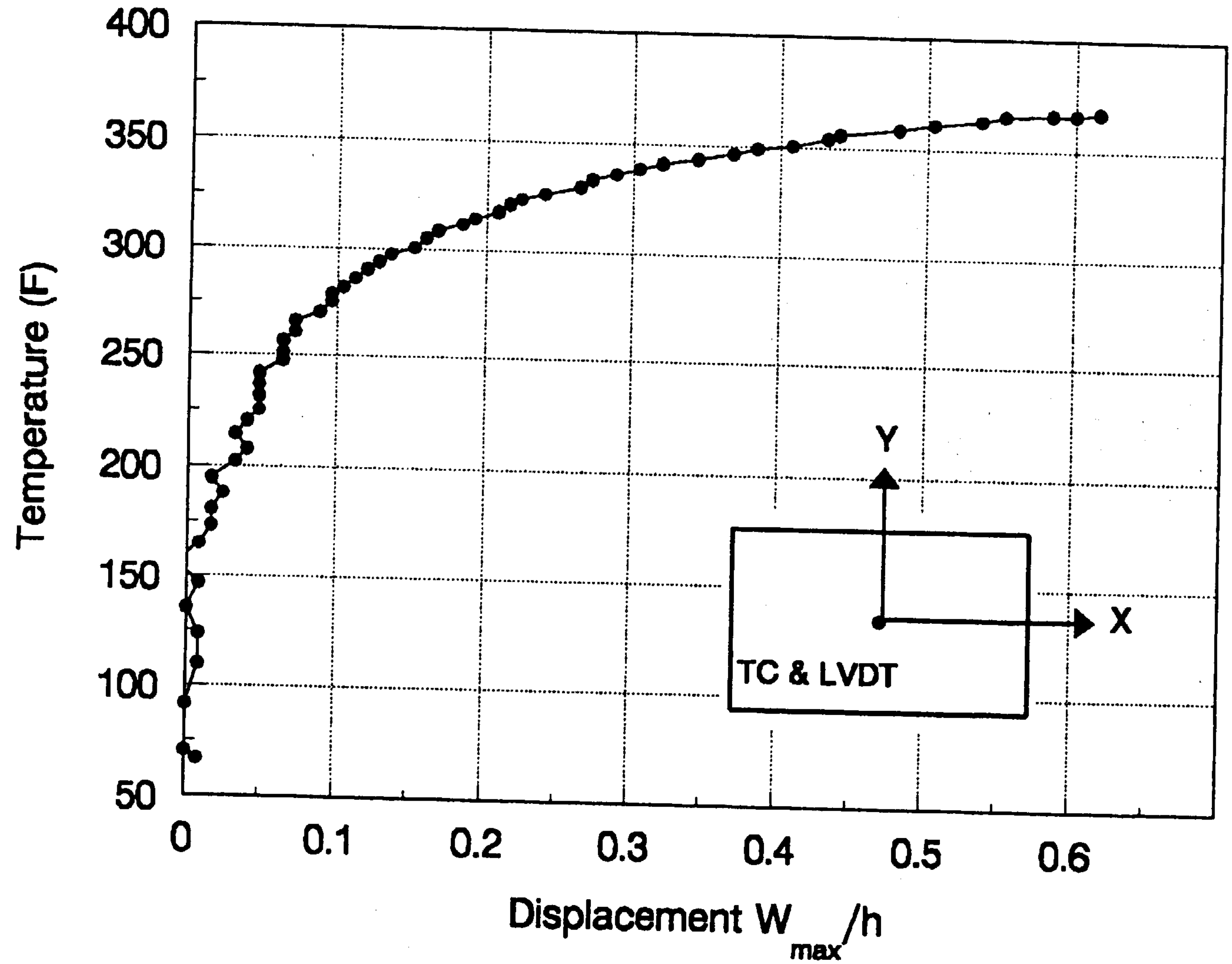


Figure 23. Plate center temperature versus displacement, Test 2.

Figure 24. Plate temperature histories, T(0,y,t), y=0,-1,-2 in. Test 5.

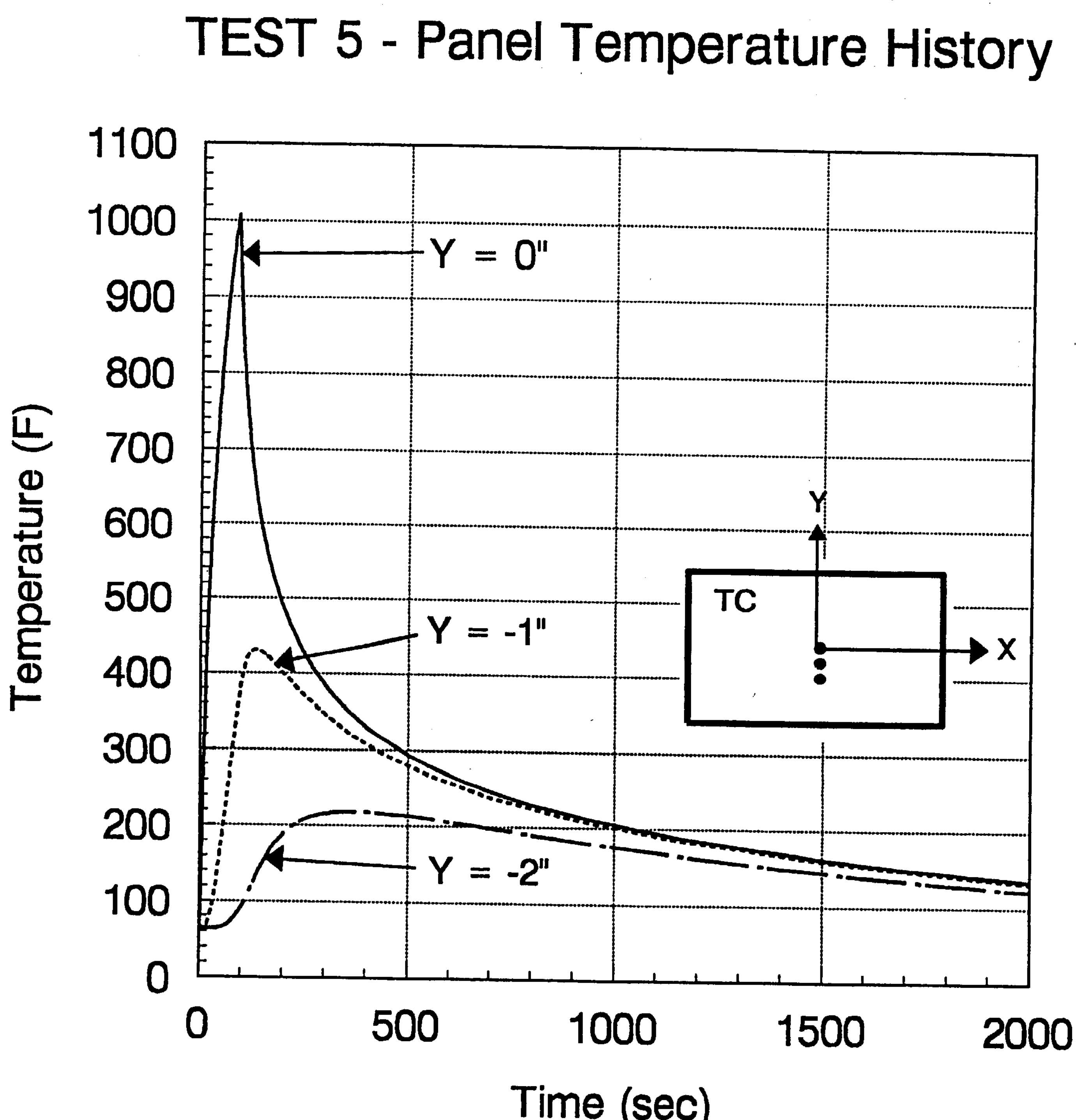
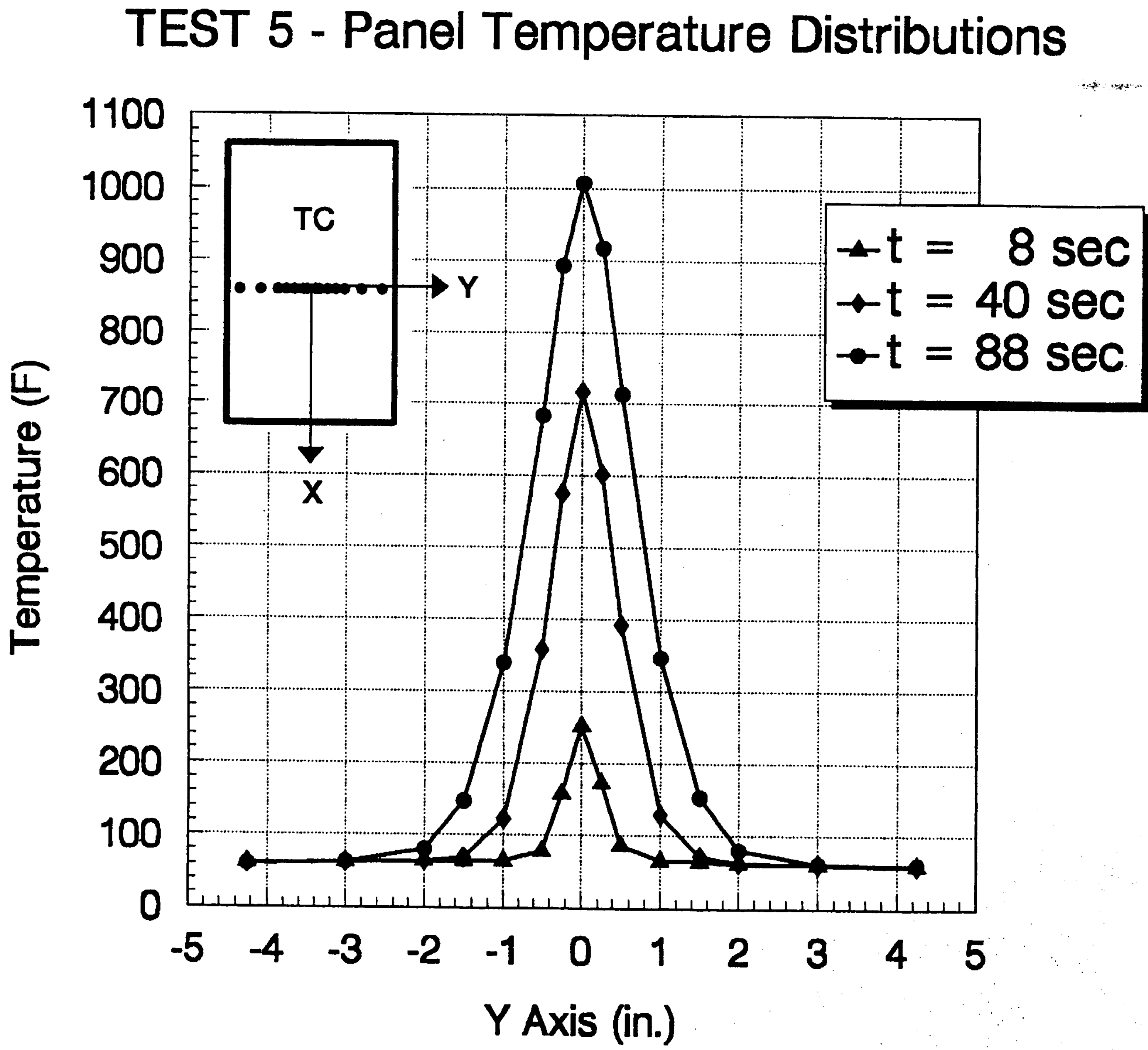


Figure 25. Plate temperature distributions, $T(0.25,y,t)$, $t=8,40,88s$. Test 5.



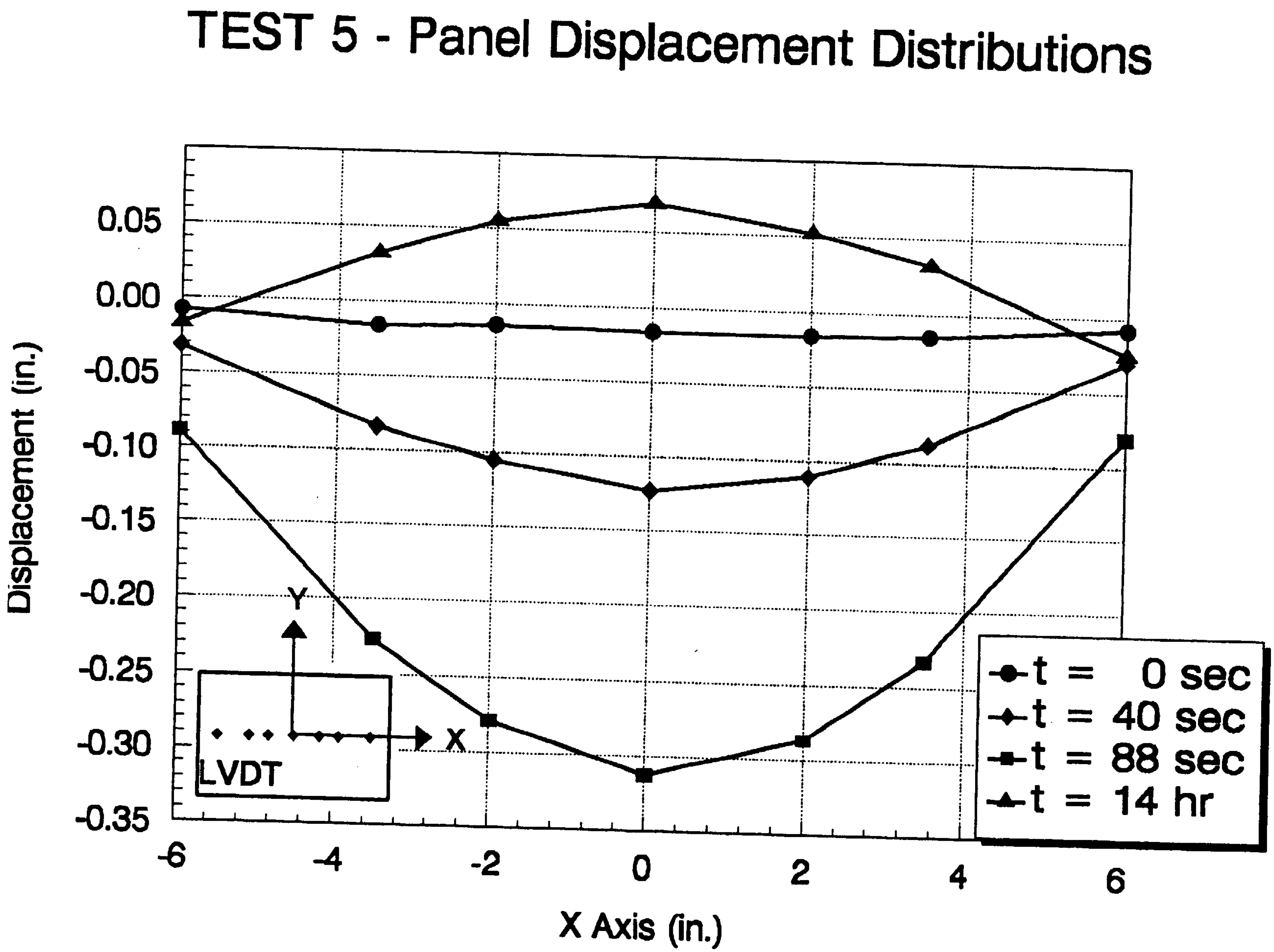


Figure 26. Plate displacement distributions, w(x,0,t), t=0,40,88s, final. Test 5.

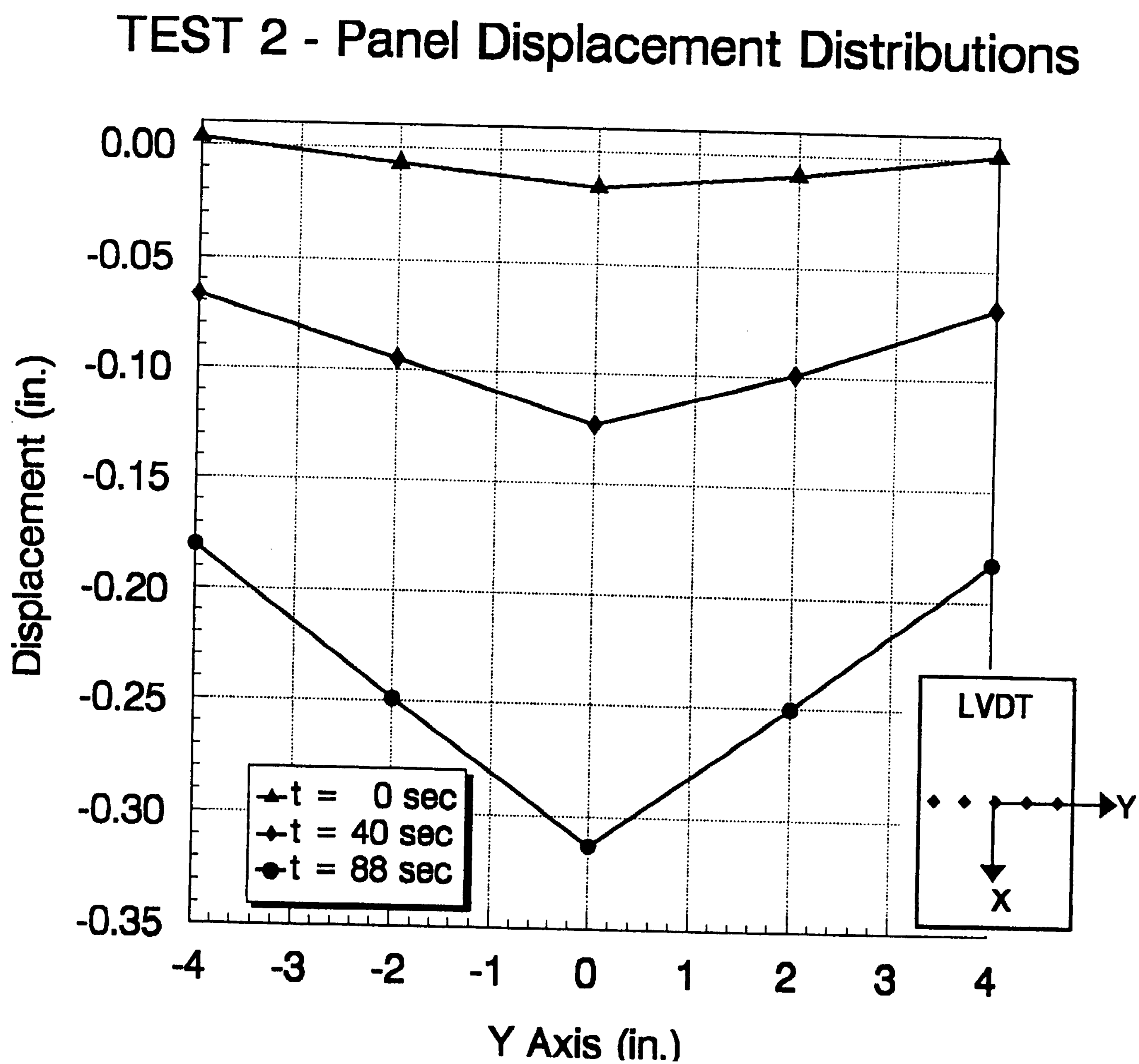


Figure 27. Plate displacement distributions, w(0,y,t), t=0,40,88s. Test 5.

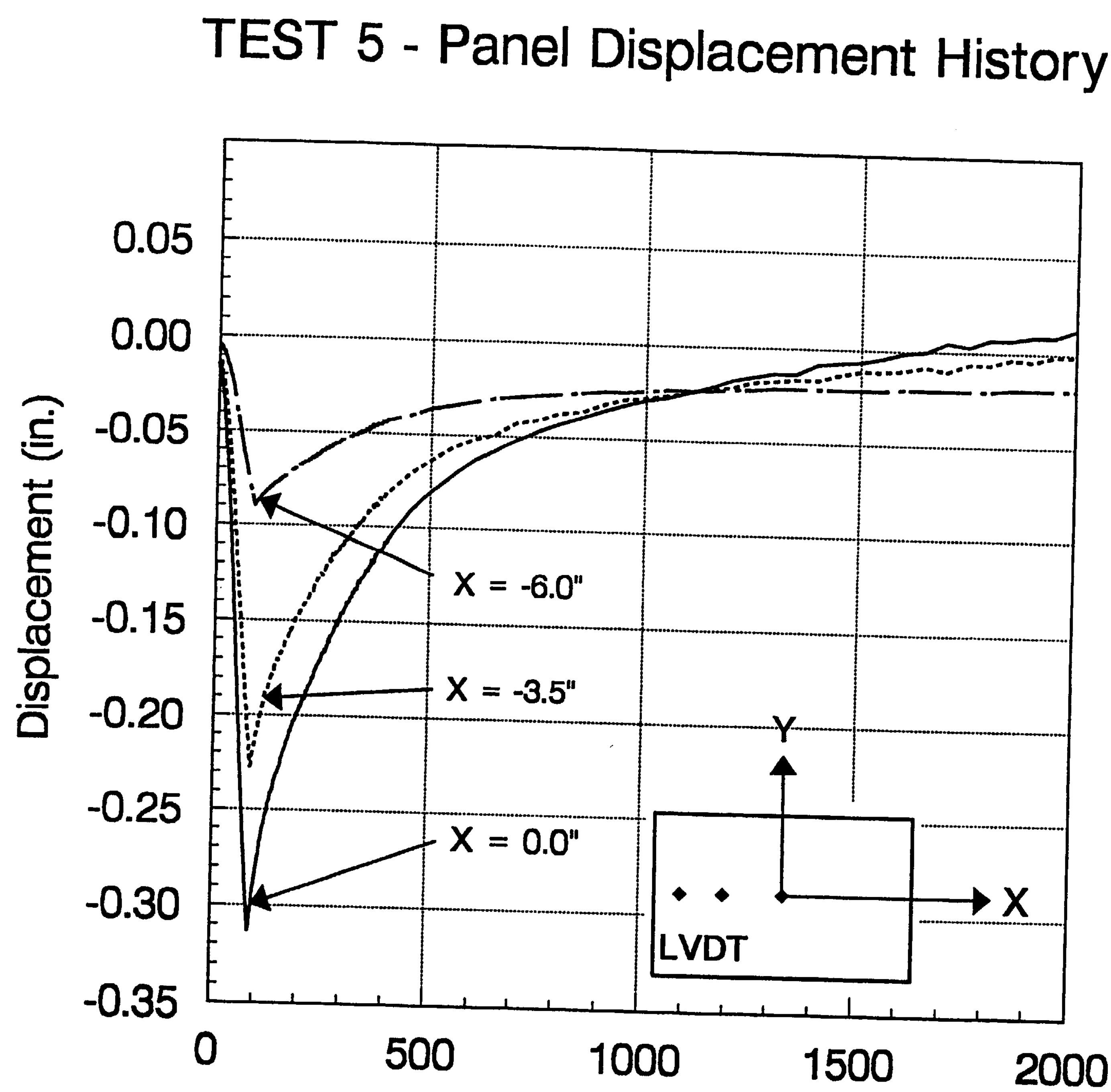


Figure 28. Plate displacement history, w(x,0,t) x=0,-3.5,-6. Test 5.

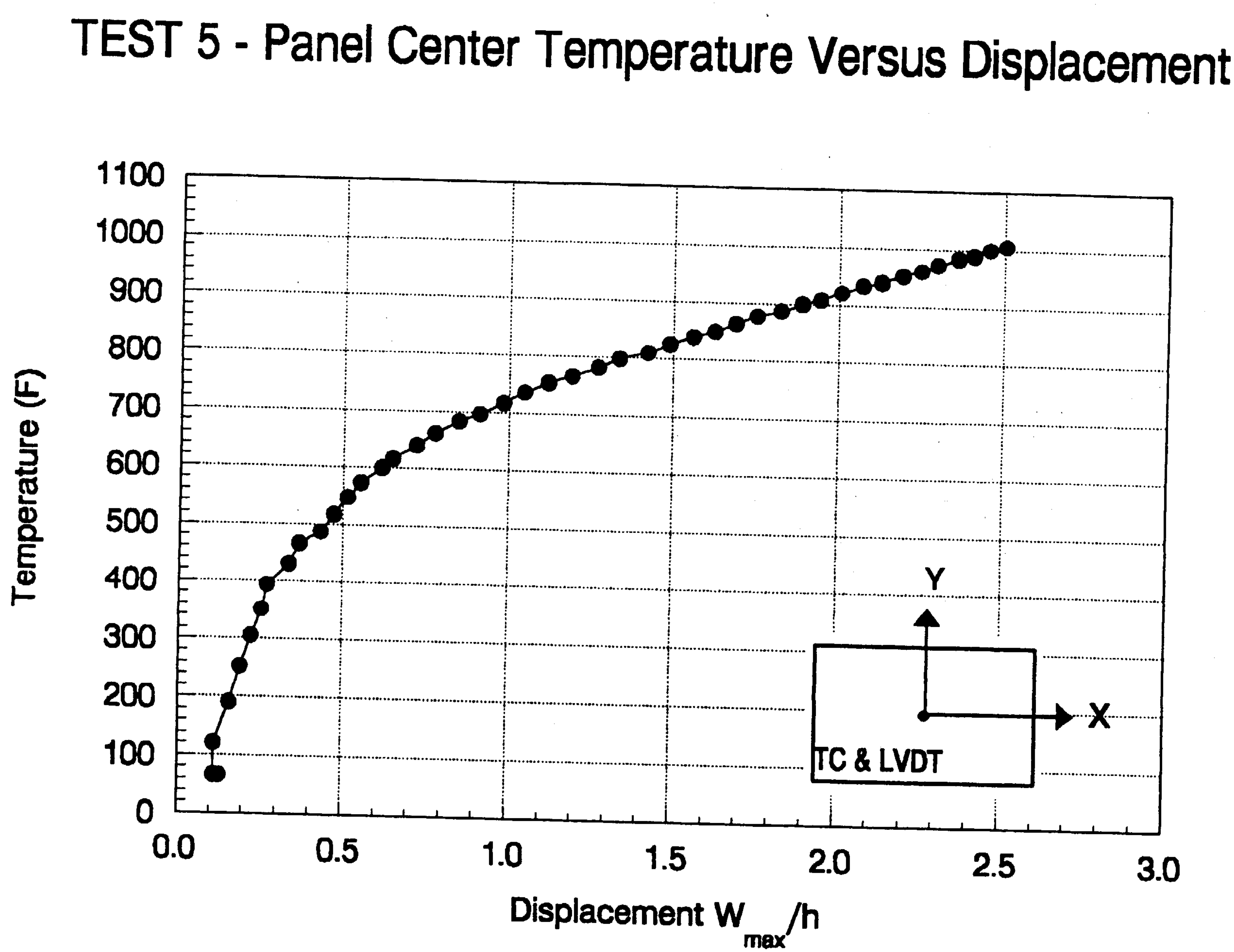


Figure 29. Plate center temperature versus displacement. Test 5.

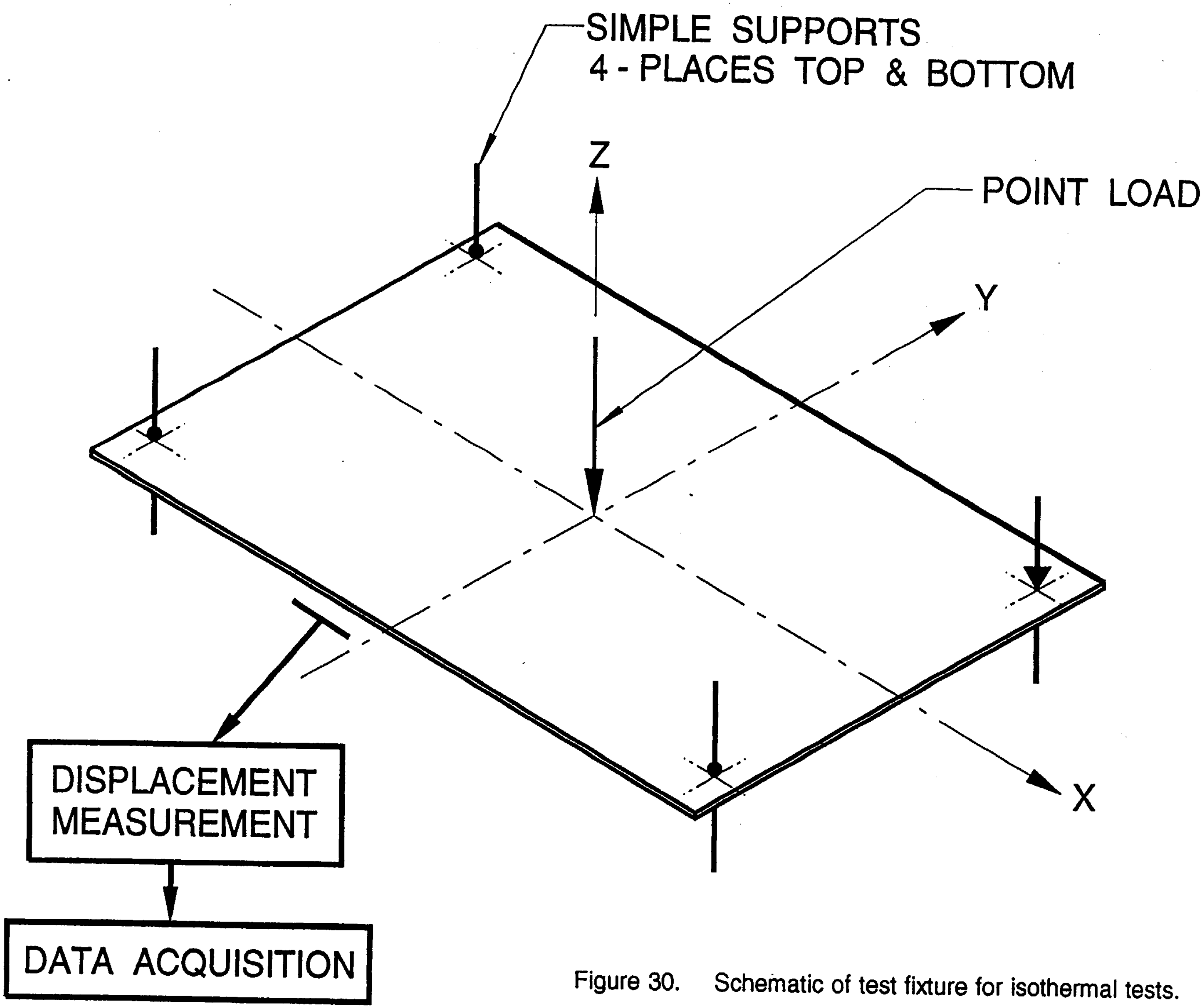


Figure 30. Schematic of test fixture for isothermal tests.

Point Load Test Setup

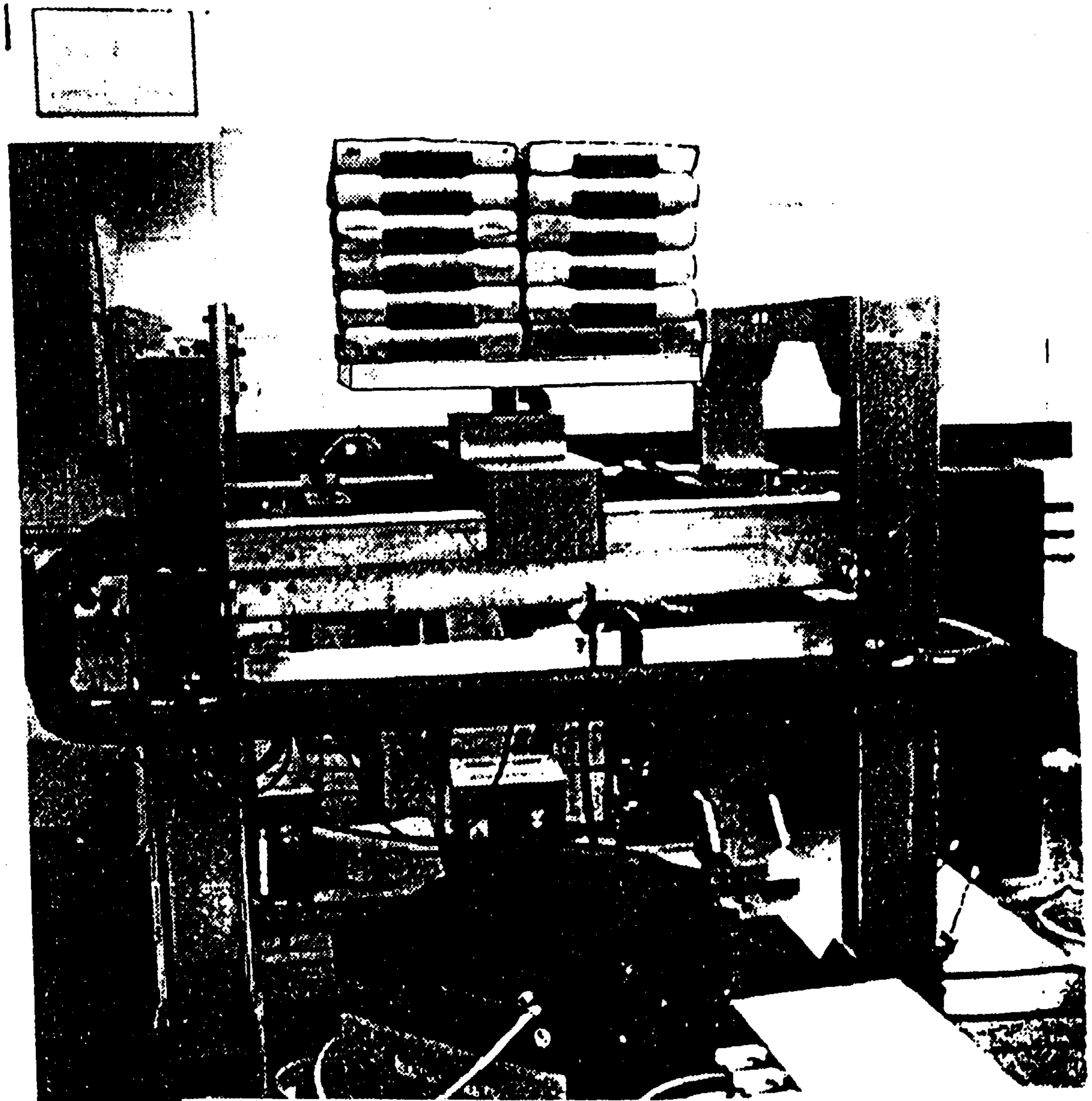


Figure 31. Photograph of test setup for isothermal tests.

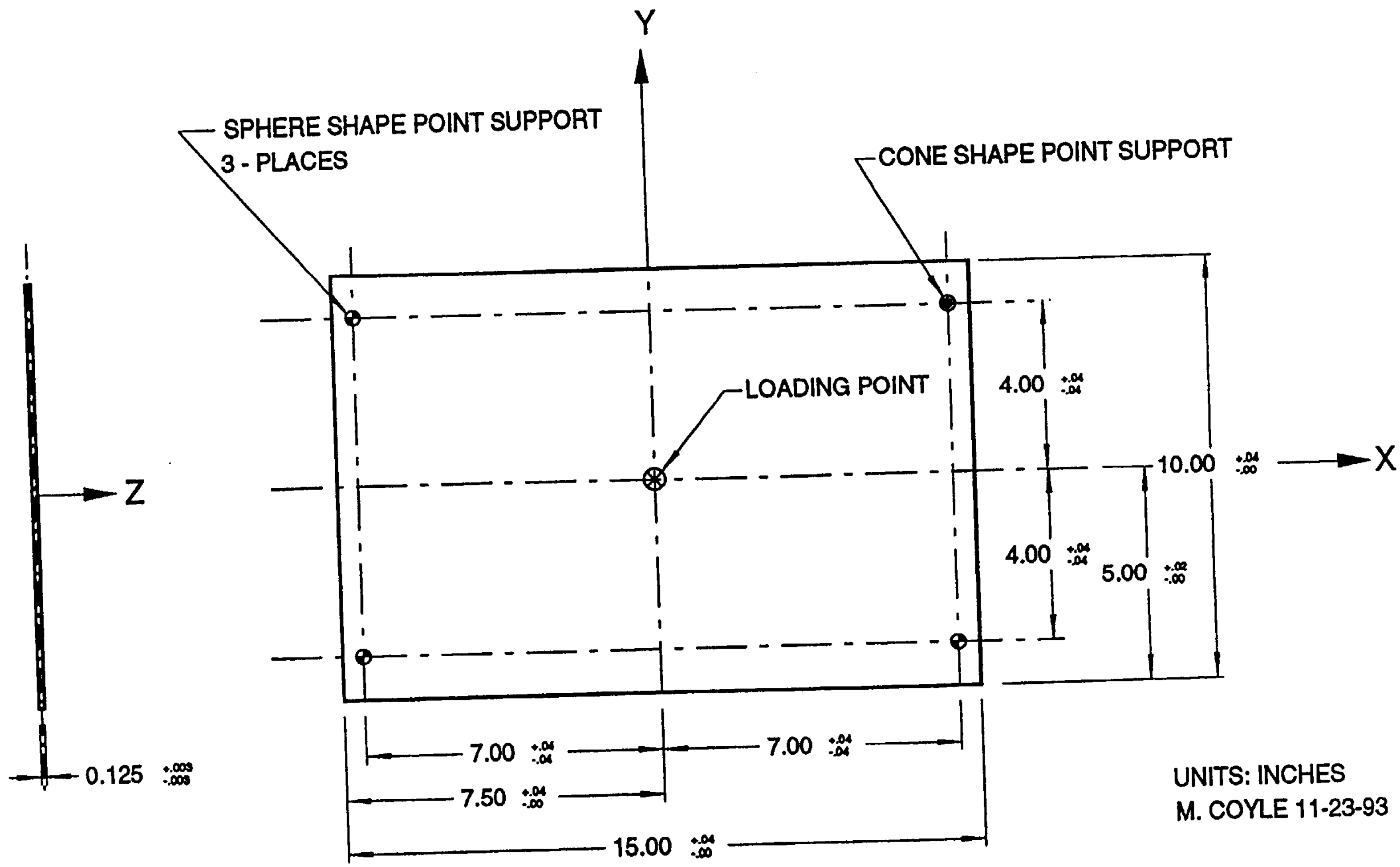


Figure 32. Plate dimensions and support locations for isothermal tests.

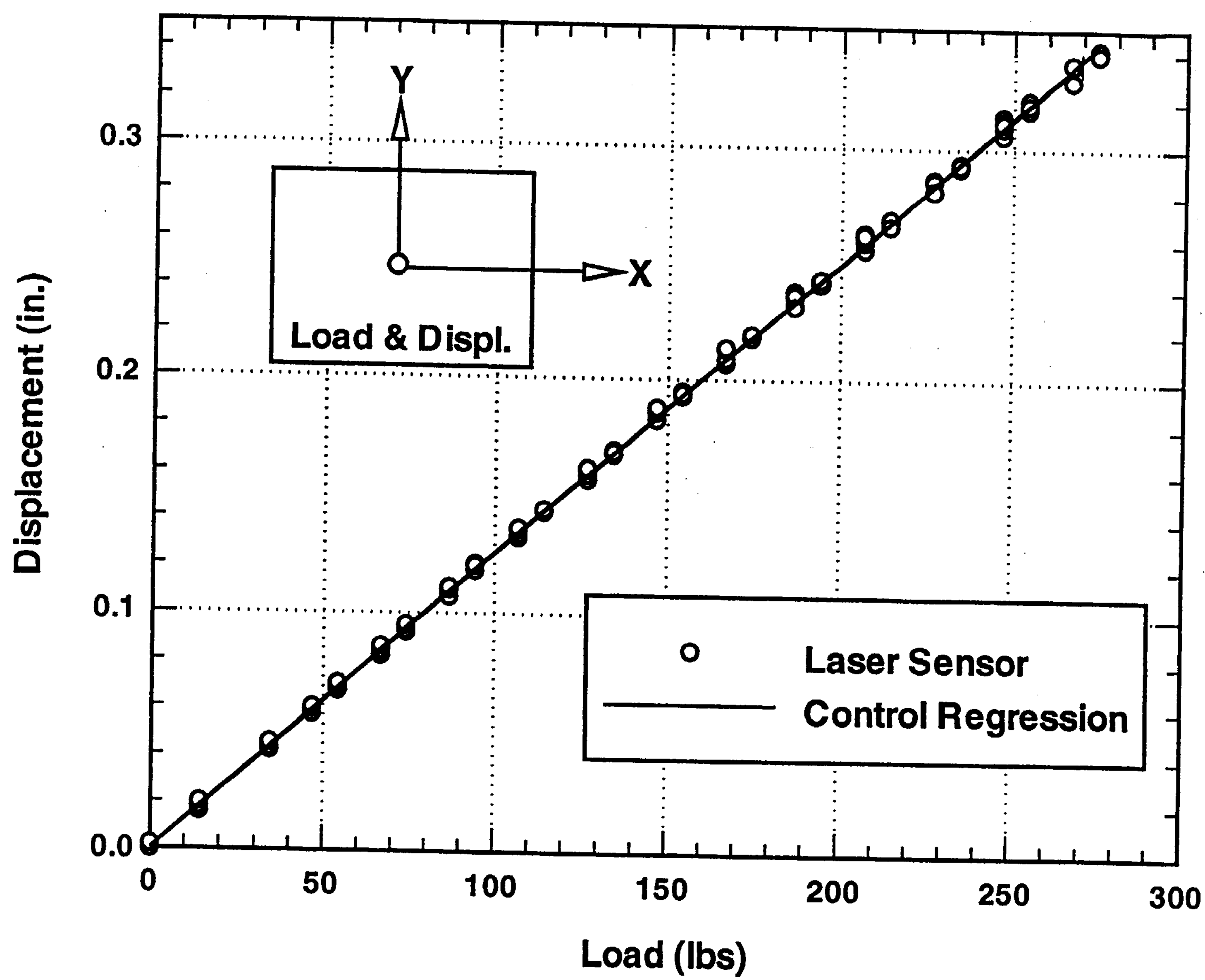


Figure 33. Laser treatment results.

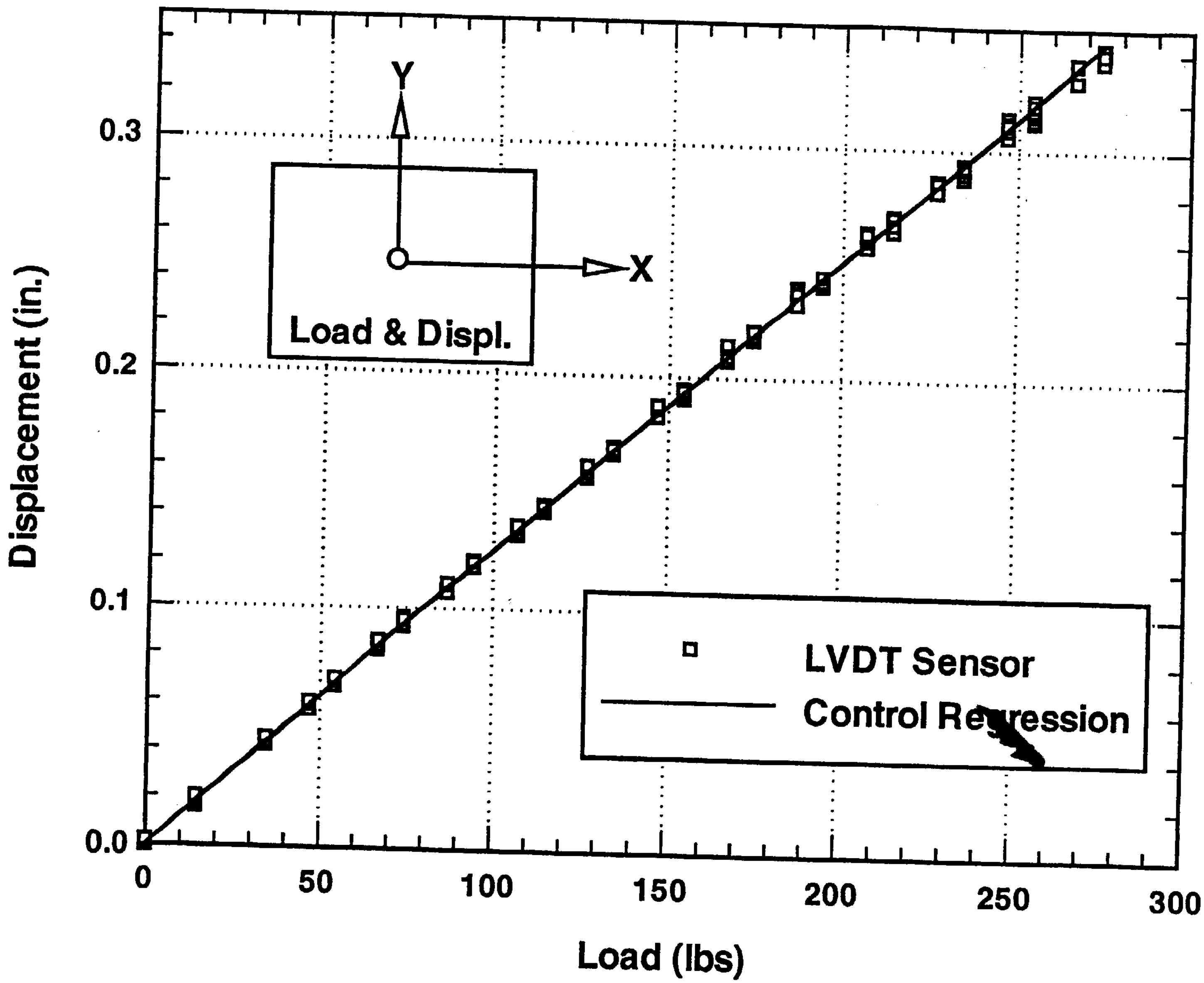


Figure 34. LVDT treatment results.

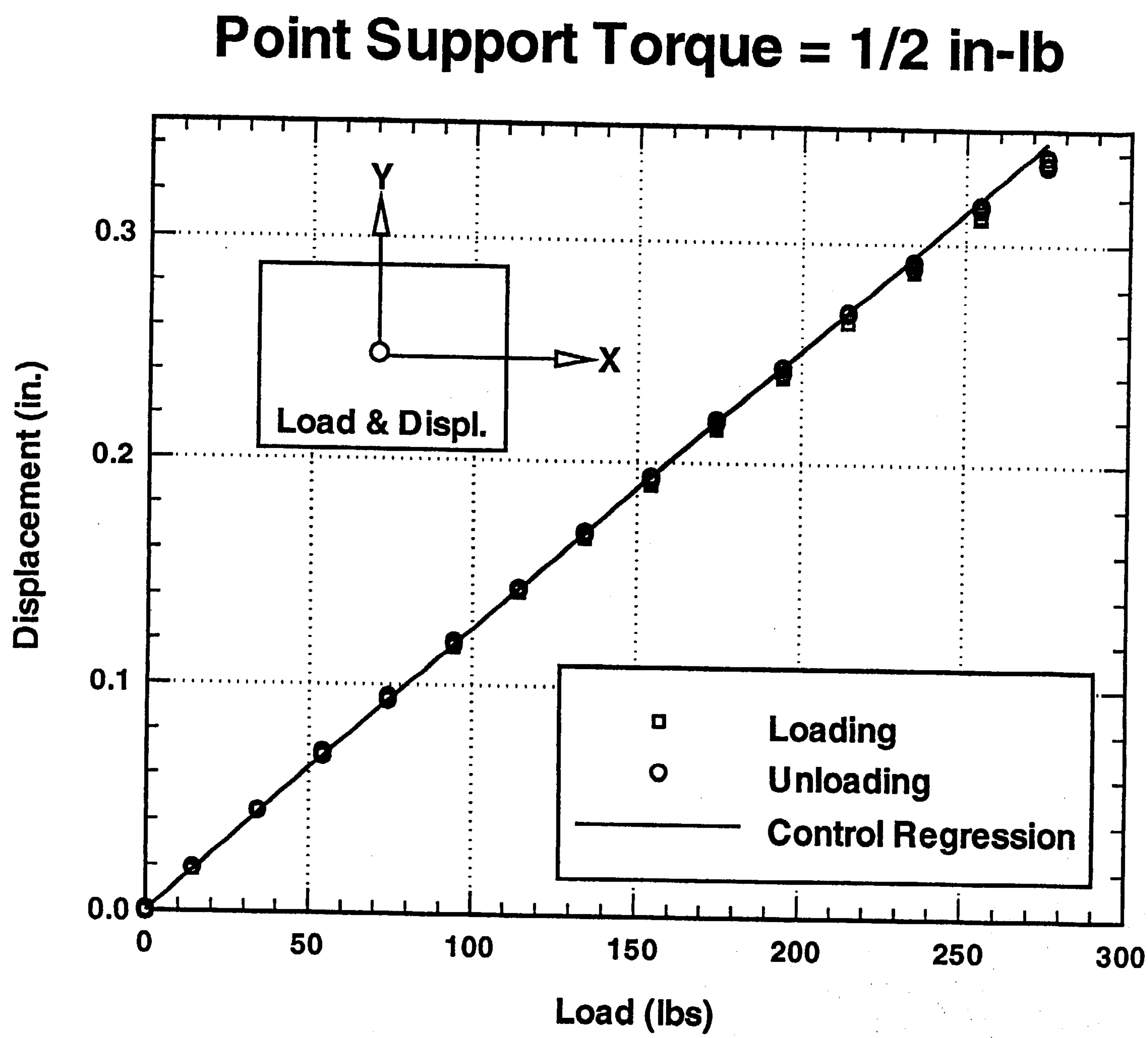


Figure 35. 1/2 in-lb support torque treatment results.

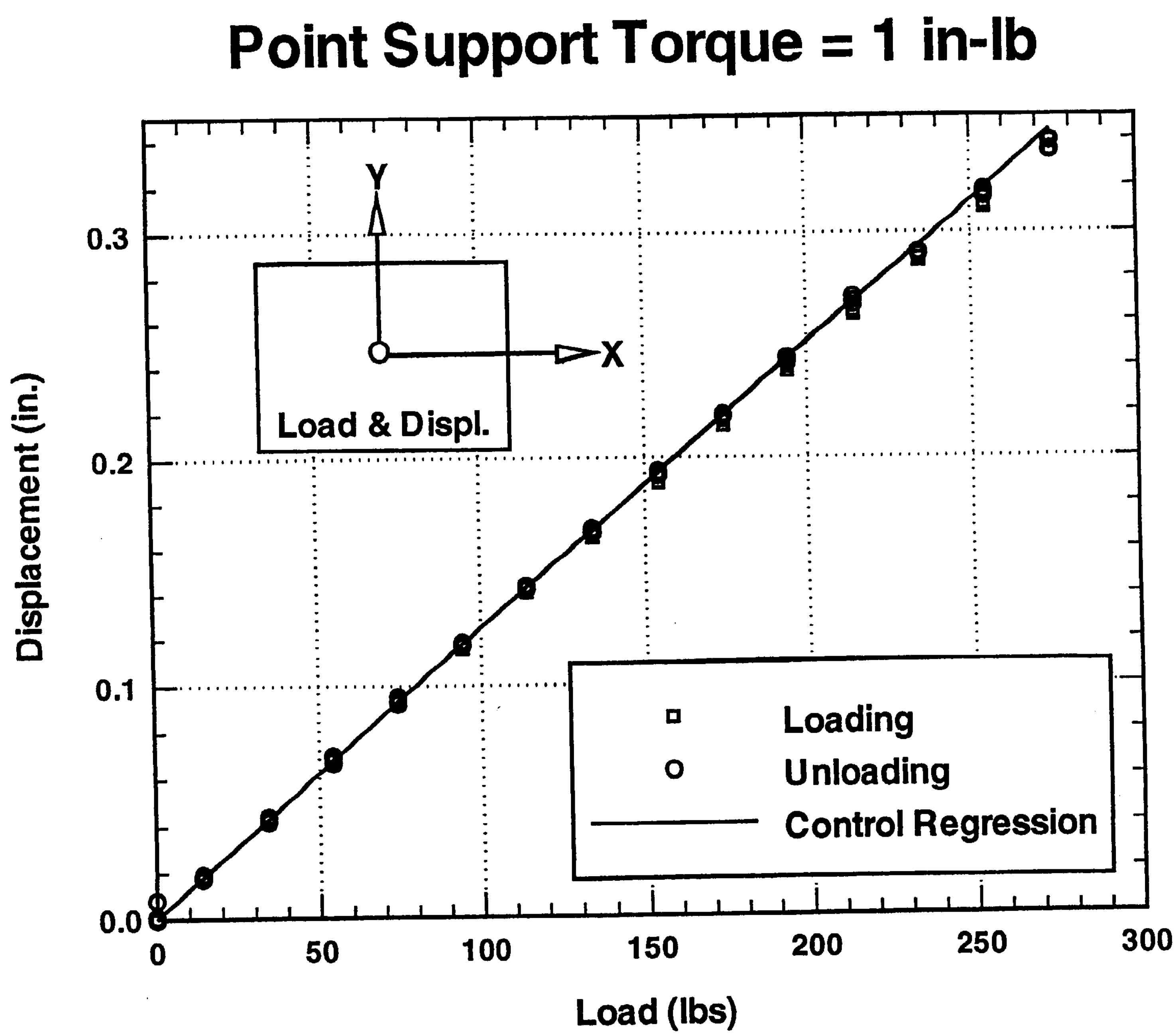


Figure 36. 1 in-lb support torque treatment results.

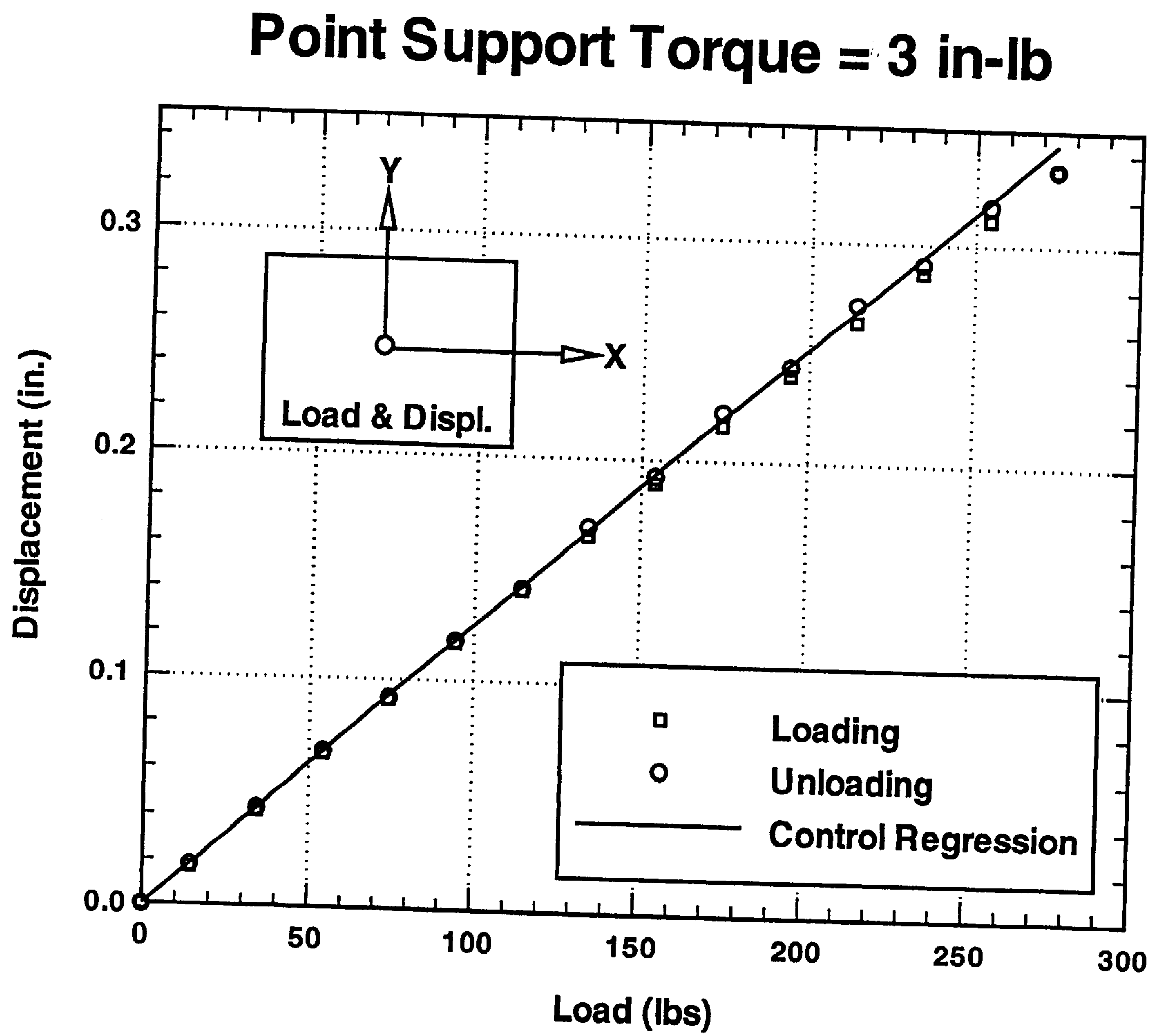


Figure 37 3 in-lb support torque treatment results.

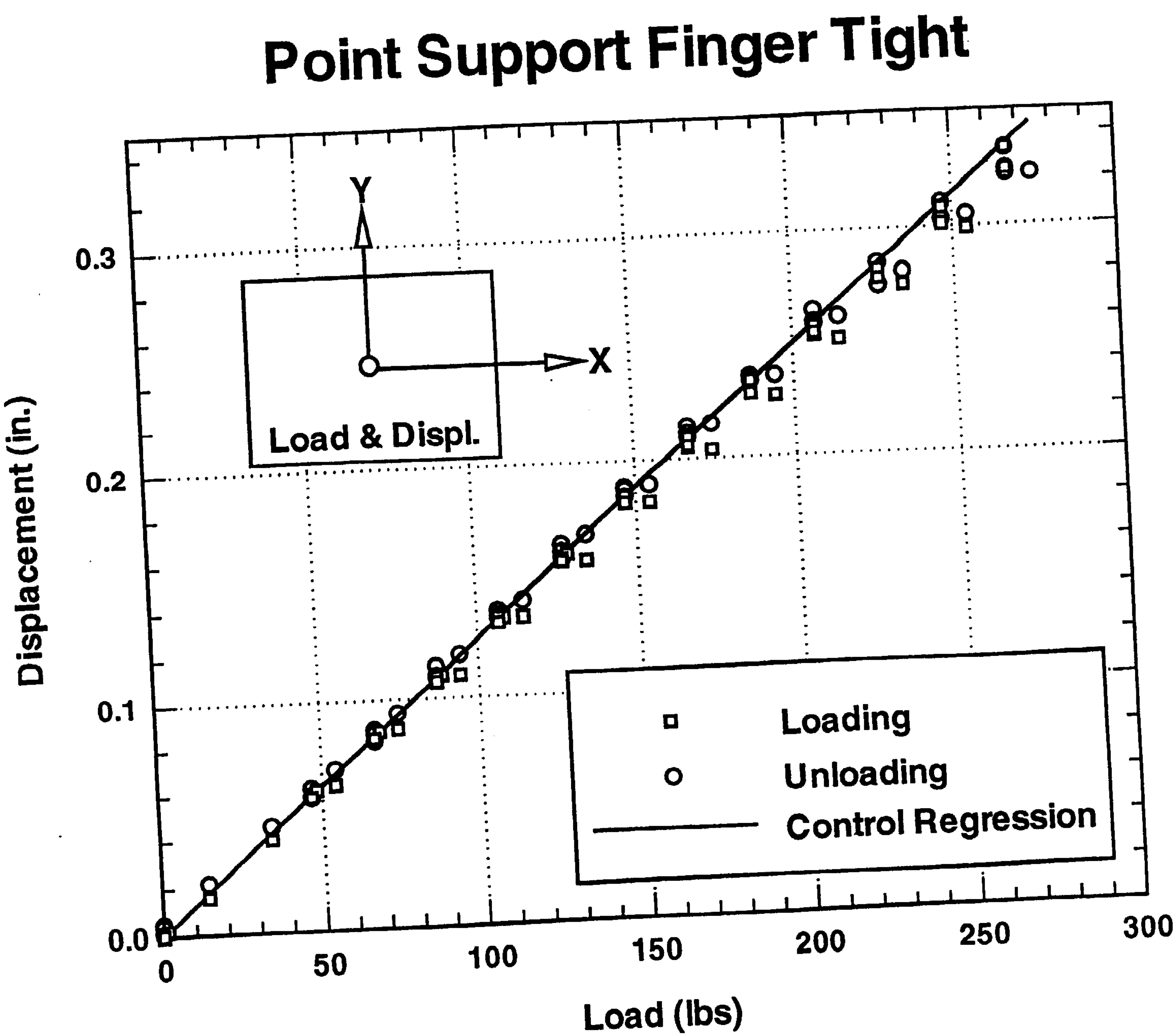


Figure 38. Finger tight (4-5 in-lb torque) support treatment results.

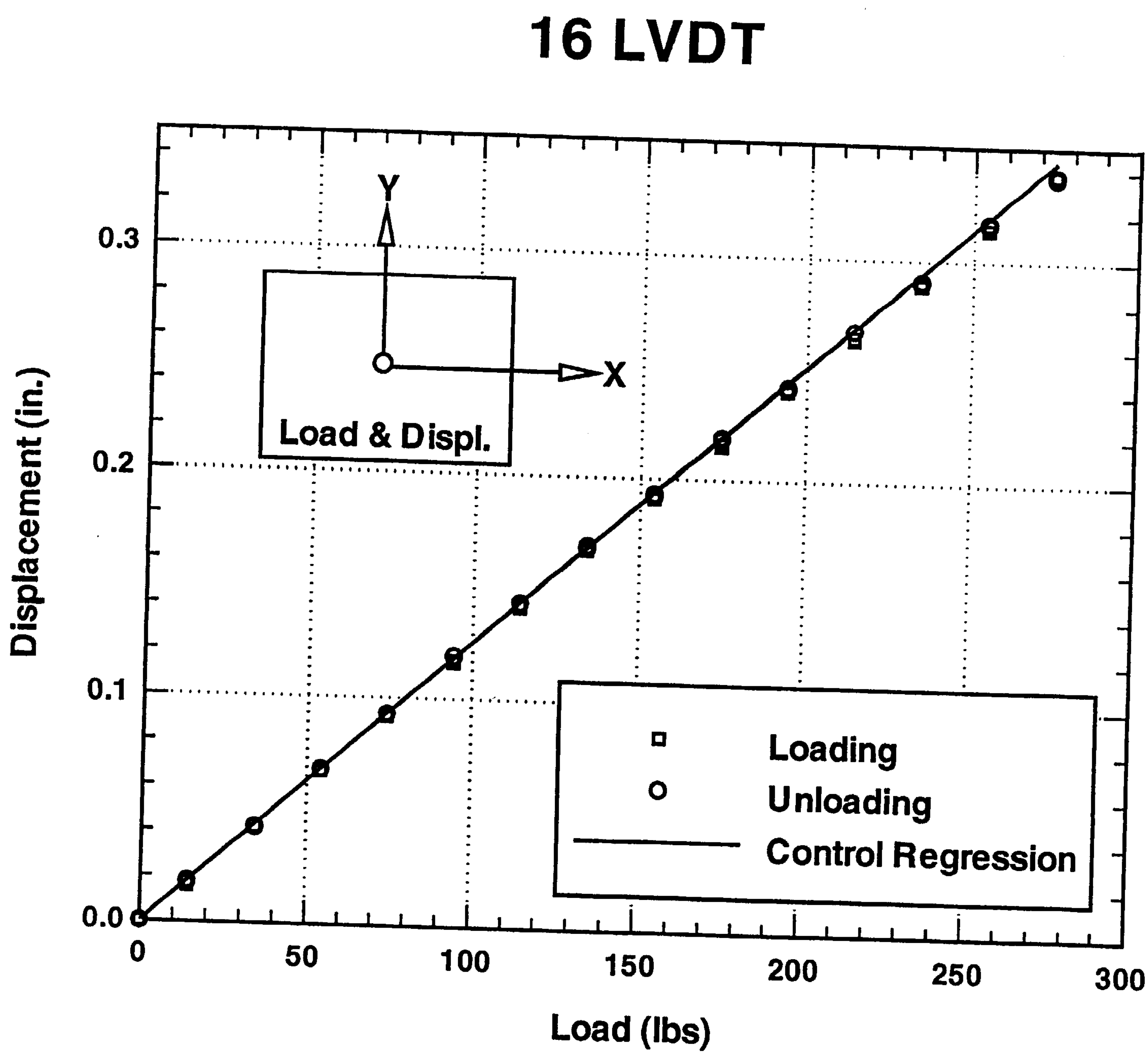


Figure 39 16 LVDT treatment results.

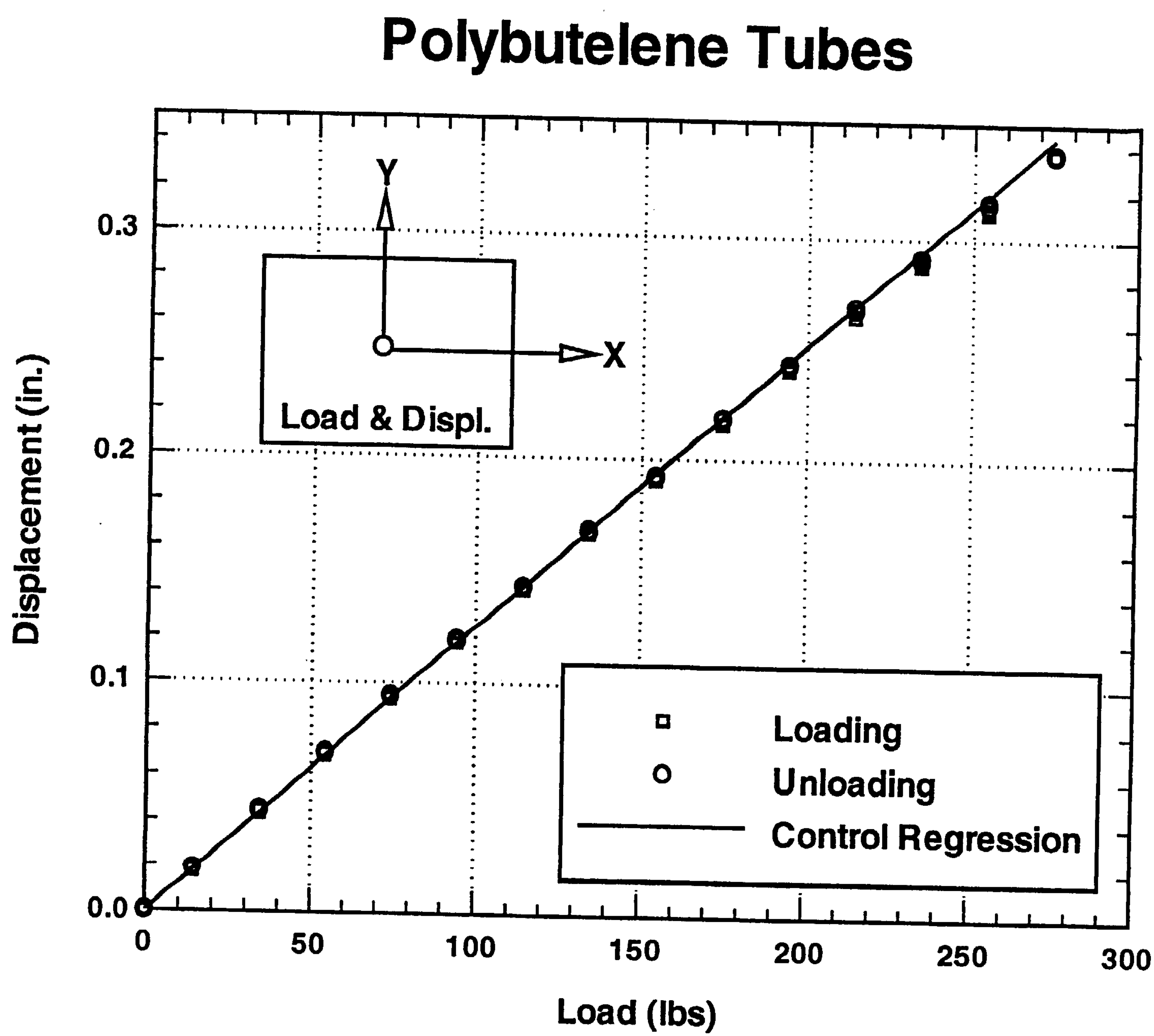


Figure 40. Plate with polybutelene pipes treatment results.

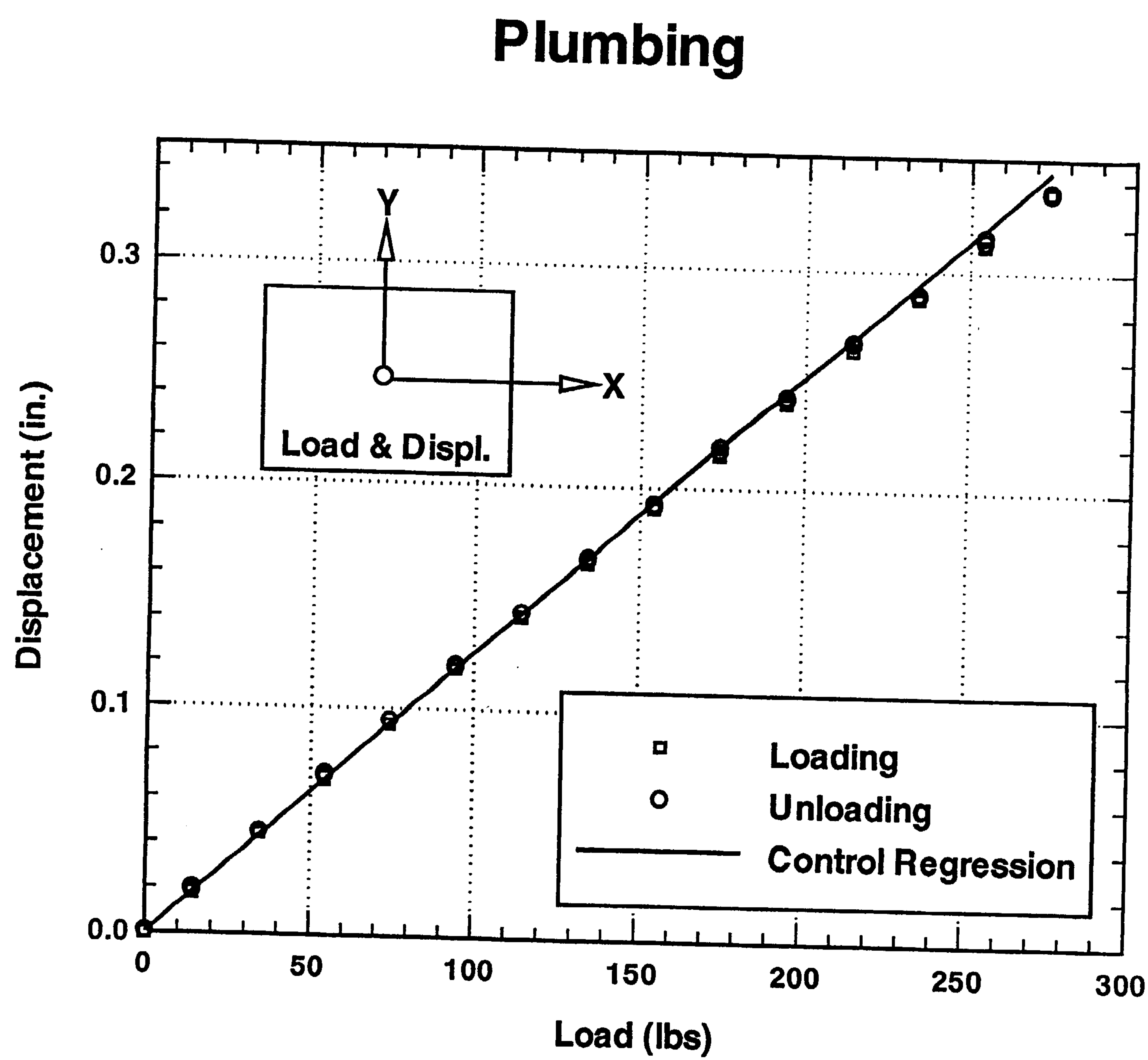


Figure 41. Plate attached to coolant plumbing treatment results.

APPENDICES

APPENDIX A

MATERIAL AND PLATE INFORMATION

NOTICE OF SHIPMENT

ALLEGHENY LUDLUM STEEL
DIVISION OF ALLEGHENY LUDLUM CORPORATION
DEDICATED TO QUALITY SPECIALTY STEEL

CERTIFICATE OF TEST

P00219BW004 | 02/20/90 | 155350 | BRACKENRIDGE, PA | 033607 | 13010103060000 | 32-020-081 | 03/26/90

3

SOLD TO
ATEK METALS CENTER INC.
10052 COMMERCE PARK DRIVE
CINCINNATI OH 4524

ATEK METALS CENTER, INC.
10052 Commerce Park Drive
Cincinnati, Ohio 45246
Phone 513/874-3490

ATEK
Metals for the Future

We certify that this is a true copy of Mill Certificate of Test Data on material used to fill your order.

Chris Phillips 4/26/90

Customer: UNIVERSITY OF VIRGINIA
P.O. No. UGR44074L-77 P/Slip 54159
Size .120/.130" X 10" X 15" Item 1
Heat No. 041061-01 Qty. 5 PC.
Date Shipped 4-26-90 S 00424BW006

GRADE AND SPECIFICATIONS
"ALTEMP" HX ALLOY SHEET C R CUT LENGTHS ANNEALED 2D FIN 3 EDGE --- PER (AMS 5536K)

ITEM	PCS	DIMENSIONS W/G/L	HEAT #	COIL #	TEST #	GROSS TARE NET THEO TAG #/ CD SKID #
001	9	36./.125/120.	041061 -01	05239N346	1349433	
	10	36./.125/120.	041061 -01	05239N346	1349433	
C						
	2	SKIDS				

CK'D OK AMS 5536K LCS Atek Metal Ctr. BY CP
CK'D OK [illegible] 5/2 Atek Metal Ctr. BY CP
CK'D OK [illegible] #3 Atek Metal Ctr. BY CP
CK'D OK [illegible] 5S Atek Metal Ctr. BY CP

DIST: CY OF CERT OF TEST TO J.MCAFOOSE - BRKN COPY OF S/O TO L. DUPAIN, W. KNELL, G. DIEFENBACH - LCH; J. MCAFOOSE, P. TAROSKY - BRKN; J. SEMAN - TECH CTR.

	C	MN	P	S	SI	CR	NI	AL	MO	CU	TI	CO
LADLE 041061-01	.06	.33	.016	.0002	.46	21.70	BAL	.10	9.13	.17	.001	1.31

	W	B	FE
LADLE 041061-01	.43	.003	19.10

ITEM	TEST NO		YIELD PSI *	TENSILE PSI	% ELONG IN 2"	% R/A	HARDNESS	BEND	CORROSION	GRAIN SIZE	HARDENABILITY
001	1349433	T	50500.	111000	50.	NR	90.HRB	T PASS	NR	5. OCCAS. 6.	NR

* Y.S. BY 0.2% OFFSET METHOD

ITEM	TEST NO	INTER-GRAN ATTACK	STRESS RUPTURE	SR ELONG
001	1349433	.0000	80.2 HRS BROKE	86.

(Continuous axial stress of 16,000 PSI @ 1500°F)

CK'D OK PDS 1520 [illegible] Atek Metal Ctr. BY CP

PAGE 01 OF CONTINUED ON NEXT PAGE

03/26/90 08:57:02

1

Hastelloy-X Certificate of Originate

NOTICE OF SHIPMENT

ALLEGHENY LUDLUM STEEL
DIVISION OF ALLEGHENY LUDLUM CORPORATION
DEDICATED TO QUALITY SPECIALTY STEEL

CERTIFICATE OF TEST

P00219SW004 | 02/20/90 | 155350 | BRACKENRIDGE, PA | 033607 | 3010 | 03060000 | 32-020-081 | 03/26/90

3 | 51767-6 | 2368 | BRACKENRIDGE | PA | 33609

SOLD TO	PRIME	SEC.	SHIP TO
ATEK METALS CENTER INC.	DSO	DBO	ATEK METAL CENTER INC
10052 COMMERCE PARK DRIVE	301	28	10052 COMMERCE PARK DRIVE
CINCINNATI OH 45246			UNION TOWNSHIP -- NEAR:
			FAIRFIELD OH 45014

GRADE AND SPECIFICATIONS FRT CHG - COLLECT CARRIER - TRUCK
"ALTEMP" HX ALLOY SHEET C R CUT LENGTHS ANNEALED 2D FIN 3 EDGE --- PER (AMS 5536K)

NR = DATA NOT REQUIRED

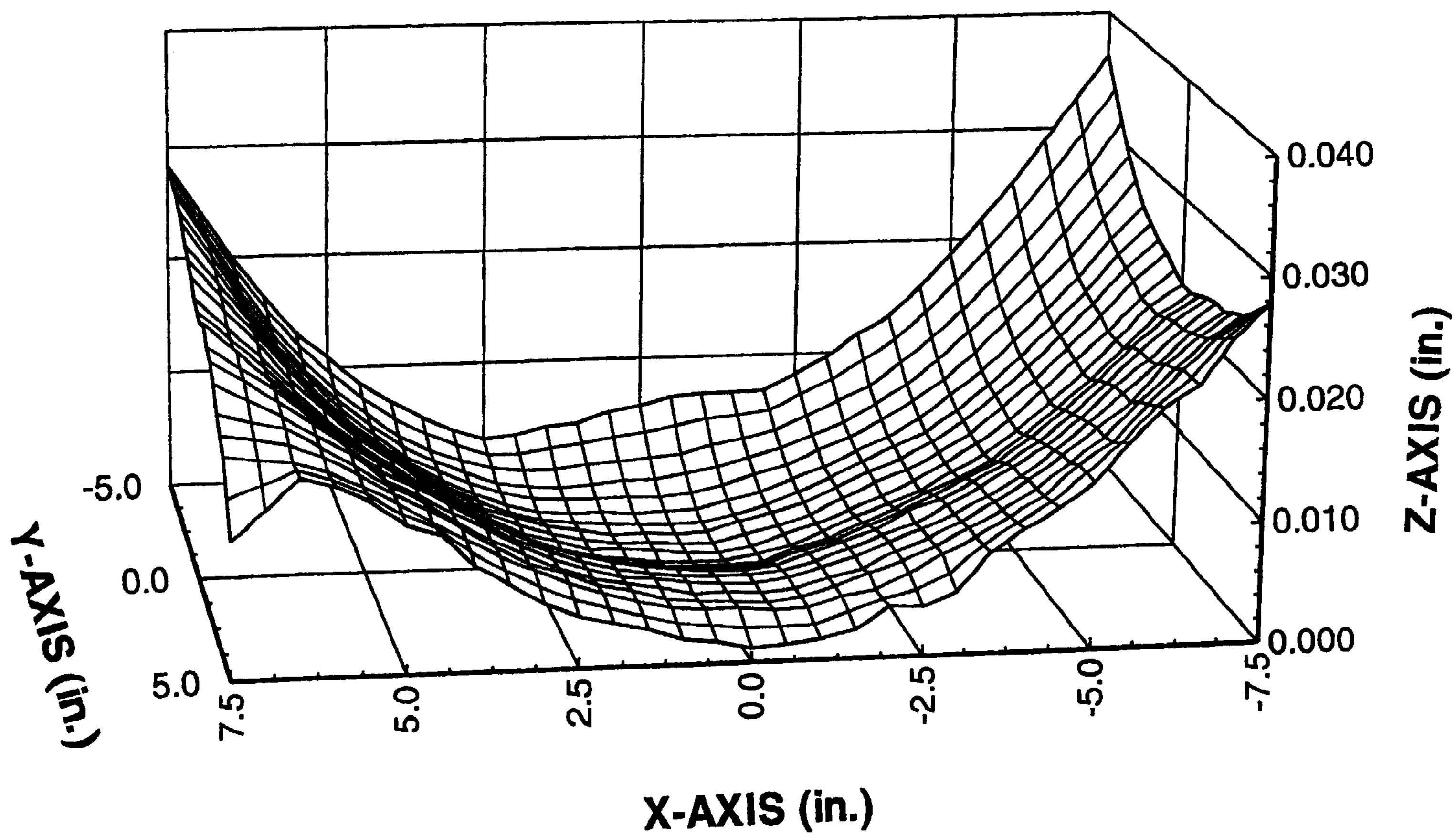
The product was solution heat treated at 2150°F ±25°F for a time commensurate with thickness and rapidly cooled.

Linda Schrecengost
Specification Clerk
3/26/90

 SHIPPING CONTROL COPY

03/26/90 08:57:20

1



Initial transverse deflection of the test plate

Initial transverse deflection of the test plate

X	Y = -4.5 in.		Y = -4.0 in.		Y = -3.5 in.		Y = -3.0 in.		Y = -2.5 in.	
(in.)	Mid-Plane (in.)	Thickness (in.)	Mid-Plane (in.)	Thickness (in.)	Mid-Plane (in.)	Thickness (in.)	Mid-Plane (in.)	Thickness (in.)	Mid-Plane (in.)	Thickness (in.)
-7.00	0.0301	0.1248	0.0277	0.1249	0.0258	0.1253	0.0243	0.1253	0.0231	0.1258
-6.50	0.0265	0.1250	0.0241	0.1252	0.0224	0.1256	0.0209	0.1253	0.0198	0.1257
-6.00	0.0230	0.1252	0.0209	0.1258	0.0191	0.1257	0.0180	0.1257	0.0169	0.1259
-5.50	0.0198	0.1254	0.0177	0.1258	0.0162	0.1259	0.0153	0.1261	0.0143	0.1260
-5.00	0.0168	0.1258	0.0149	0.1259	0.0137	0.1261	0.0126	0.1262	0.0117	0.1262
-4.50	0.0141	0.1255	0.0126	0.1262	0.0113	0.1261	0.0103	0.1263	0.0097	0.1265
-4.00	0.0118	0.1260	0.0104	0.1261	0.0092	0.1262	0.0086	0.1265	0.0077	0.1267
-3.50	0.0100	0.1259	0.0084	0.1266	0.0077	0.1266	0.0069	0.1265	0.0062	0.1270
-3.00	0.0084	0.1259	0.0072	0.1265	0.0060	0.1266	0.0056	0.1268	0.0050	0.1269
-2.50	0.0071	0.1259	0.0059	0.1265	0.0051	0.1268	0.0044	0.1266	0.0037	0.1269
-2.00	0.0058	0.1259	0.0048	0.1265	0.0039	0.1265	0.0032	0.1267	0.0027	0.1269
-1.50	0.0054	0.1261	0.0041	0.1265	0.0033	0.1266	0.0024	0.1267	0.0017	0.1269
-1.00	0.0052	0.1260	0.0036	0.1269	0.0024	0.1266	0.0016	0.1268	0.0011	0.1268
-0.50	0.0047	0.1261	0.0029	0.1266	0.0019	0.1265	0.0010	0.1269	0.0004	0.1271
0.00	0.0042	0.1260	0.0027	0.1267	0.0015	0.1266	0.0007	0.1267	0.0003	0.1270
0.50	0.0039	0.1258	0.0024	0.1265	0.0015	0.1266	0.0008	0.1268	0.0002	0.1268
1.00	0.0033	0.1261	0.0022	0.1265	0.0012	0.1266	0.0007	0.1266	0.0004	0.1271
1.50	0.0030	0.1262	0.0018	0.1264	0.0010	0.1265	0.0007	0.1269	0.0004	0.1267
2.00	0.0026	0.1258	0.0018	0.1267	0.0012	0.1265	0.0009	0.1265	0.0006	0.1269
2.50	0.0026	0.1259	0.0021	0.1264	0.0016	0.1268	0.0015	0.1266	0.0014	0.1267
3.00	0.0035	0.1261	0.0029	0.1264	0.0026	0.1267	0.0025	0.1262	0.0024	0.1264
3.50	0.0046	0.1257	0.0039	0.1263	0.0037	0.1264	0.0036	0.1265	0.0036	0.1264
4.00	0.0060	0.1259	0.0052	0.1260	0.0051	0.1262	0.0050	0.1265	0.0051	0.1263
4.50	0.0079	0.1257	0.0073	0.1261	0.0072	0.1262	0.0070	0.1261	0.0070	0.1261
5.00	0.0102	0.1256	0.0095	0.1259	0.0093	0.1260	0.0092	0.1263	0.0092	0.1261
5.50	0.0127	0.1254	0.0122	0.1257	0.0120	0.1258	0.0120	0.1260	0.0119	0.1260
6.00	0.0159	0.1251	0.0154	0.1256	0.0152	0.1258	0.0150	0.1258	0.0150	0.1258
6.50	0.0196	0.1249	0.0193	0.1255	0.0189	0.1256	0.0188	0.1257	0.0185	0.1258
7.00	0.0239	0.1248	0.0235	0.1253	0.0233	0.1255	0.0229	0.1254	0.0225	0.1253

	Y = -2.0 in.		Y = -1.5 in.		Y = -1.0 in.		Y = -0.5 in.		Y = 0.0 in.	
X (in.)	Mid-Plane (in.)	Thickness (in.)	Mid-Plane (in.)	Thickness (in.)	Mid-Plane (in.)	Thickness (in.)	Mid-Plane (in.)	Thickness (in.)	Mid-Plane (in.)	Thickness (in.)
-7.00	0.0224	0.1254	0.0218	0.1257	0.0214	0.1257	0.0206	0.1255	0.0206	0.1254
-6.50	0.0191	0.1257	0.0188	0.1259	0.0184	0.1256	0.0179	0.1262	0.0177	0.1259
-6.00	0.0163	0.1255	0.0160	0.1259	0.0157	0.1263	0.0154	0.1260	0.0151	0.1260
-5.50	0.0136	0.1262	0.0134	0.1262	0.0132	0.1260	0.0129	0.1261	0.0127	0.1259
-5.00	0.0112	0.1263	0.0111	0.1264	0.0108	0.1263	0.0104	0.1263	0.0104	0.1260
-4.50	0.0091	0.1262	0.0089	0.1265	0.0087	0.1264	0.0085	0.1265	0.0084	0.1265
-4.00	0.0073	0.1265	0.0073	0.1267	0.0070	0.1264	0.0069	0.1265	0.0070	0.1265
-3.50	0.0061	0.1267	0.0058	0.1267	0.0056	0.1263	0.0055	0.1266	0.0054	0.1269
-3.00	0.0049	0.1261	0.0047	0.1267	0.0046	0.1269	0.0042	0.1267	0.0043	0.1271
-2.50	0.0035	0.1268	0.0036	0.1272	0.0033	0.1267	0.0031	0.1267	0.0034	0.1270
-2.00	0.0024	0.1266	0.0023	0.1270	0.0020	0.1269	0.0020	0.1268	0.0022	0.1265
-1.50	0.0013	0.1269	0.0015	0.1268	0.0011	0.1271	0.0012	0.1269	0.0011	0.1268
-1.00	0.0006	0.1270	0.0008	0.1271	0.0005	0.1267	0.0003	0.1265	0.0004	0.1265
-0.50	0.0000	0.1270	0.0000	0.1268	-0.0001	0.1274	-0.0002	0.1267	0.0000	0.1268
0.00	-0.0001	0.1270	-0.0001	0.1270	-0.0001	0.1269	-0.0001	0.1271	0.0000	0.1271
0.50	0.0000	0.1267	0.0001	0.1269	0.0001	0.1273	0.0002	0.1271	0.0001	0.1270
1.00	0.0001	0.1269	0.0000	0.1269	0.0001	0.1269	0.0004	0.1270	0.0004	0.1268
1.50	0.0003	0.1268	0.0005	0.1267	0.0005	0.1269	0.0004	0.1271	0.0007	0.1265
2.00	0.0006	0.1268	0.0009	0.1270	0.0011	0.1270	0.0013	0.1267	0.0013	0.1267
2.50	0.0014	0.1265	0.0019	0.1269	0.0019	0.1266	0.0020	0.1266	0.0024	0.1267
3.00	0.0025	0.1266	0.0027	0.1267	0.0030	0.1265	0.0033	0.1266	0.0034	0.1264
3.50	0.0038	0.1263	0.0042	0.1267	0.0045	0.1266	0.0047	0.1266	0.0049	0.1263
4.00	0.0054	0.1261	0.0057	0.1269	0.0060	0.1263	0.0062	0.1264	0.0066	0.1265
4.50	0.0072	0.1263	0.0076	0.1264	0.0080	0.1265	0.0080	0.1266	0.0083	0.1264
5.00	0.0094	0.1261	0.0098	0.1262	0.0099	0.1265	0.0100	0.1265	0.0102	0.1262
5.50	0.0120	0.1260	0.0123	0.1262	0.0124	0.1261	0.0123	0.1261	0.0125	0.1260
6.00	0.0148	0.1259	0.0152	0.1259	0.0149	0.1259	0.0148	0.1258	0.0148	0.1257
6.50	0.0185	0.1255	0.0184	0.1254	0.0182	0.1260	0.0177	0.1257	0.0176	0.1257
7.00	0.0219	0.1257	0.0215	0.1254	0.0211	0.1255	0.0203	0.1256	0.0200	0.1252

X (in.)	Y = 0.5 in. Mid-Plane (in.)	Thickness (in.)	Y = 1.0 in. Mid-Plane (in.)	Thickness (in.)	Y =1.5 in. Mid-Plane (in.)	Thickness (in.)	Y = 2.0 in. Mid-Plane (in.)	Thickness (in.)	Y = 2.5 in. Mid-Plane (in.)	Thickness (in.)
-7.00	0.0206	0.1255	0.0210	0.1255	0.0214	0.1254	0.0215	0.1255	0.0220	0.1252
-6.50	0.0178	0.1257	0.0186	0.1255	0.0190	0.1257	0.0190	0.1253	0.0193	0.1248
-6.00	0.0152	0.1257	0.0159	0.1257	0.0164	0.1259	0.0169	0.1255	0.0170	0.1251
-5.50	0.0129	0.1257	0.0135	0.1261	0.0139	0.1261	0.0144	0.1258	0.0147	0.1261
-5.00	0.0108	0.1262	0.0114	0.1260	0.0117	0.1263	0.0122	0.1261	0.0125	0.1258
-4.50	0.0087	0.1261	0.0093	0.1267	0.0099	0.1259	0.0104	0.1262	0.0104	0.1261
-4.00	0.0072	0.1263	0.0080	0.1266	0.0084	0.1263	0.0088	0.1261	0.0088	0.1263
-3.50	0.0061	0.1265	0.0066	0.1269	0.0070	0.1265	0.0073	0.1263	0.0075	0.1261
-3.00	0.0048	0.1261	0.0053	0.1267	0.0062	0.1275	0.0060	0.1266	0.0063	0.1262
-2.50	0.0036	0.1263	0.0042	0.1267	0.0046	0.1268	0.0050	0.1266	0.0053	0.1265
-2.00	0.0024	0.1265	0.0031	0.1268	0.0038	0.1268	0.0040	0.1267	0.0041	0.1265
-1.50	0.0017	0.1272	0.0023	0.1268	0.0028	0.1267	0.0031	0.1269	0.0034	0.1266
-1.00	0.0006	0.1266	0.0014	0.1269	0.0020	0.1267	0.0024	0.1269	0.0026	0.1268
-0.50	0.0005	0.1268	0.0011	0.1269	0.0017	0.1267	0.0021	0.1269	0.0022	0.1269
0.00	0.0005	0.1269	0.0011	0.1267	0.0017	0.1267	0.0021	0.1270	0.0024	0.1268
0.50	0.0005	0.1265	0.0013	0.1268	0.0020	0.1268	0.0022	0.1267	0.0026	0.1268
1.00	0.0012	0.1267	0.0016	0.1268	0.0023	0.1267	0.0025	0.1266	0.0029	0.1267
1.50	0.0013	0.1265	0.0021	0.1267	0.0028	0.1267	0.0030	0.1267	0.0031	0.1268
2.00	0.0020	0.1266	0.0026	0.1267	0.0034	0.1266	0.0037	0.1267	0.0040	0.1264
2.50	0.0029	0.1269	0.0038	0.1267	0.0042	0.1264	0.0046	0.1267	0.0048	0.1263
3.00	0.0041	0.1264	0.0048	0.1267	0.0055	0.1266	0.0057	0.1264	0.0060	0.1262
3.50	0.0056	0.1262	0.0063	0.1265	0.0069	0.1264	0.0073	0.1261	0.0075	0.1264
4.00	0.0071	0.1260	0.0078	0.1263	0.0082	0.1262	0.0089	0.1264	0.0089	0.1260
4.50	0.0087	0.1264	0.0095	0.1263	0.0098	0.1261	0.0103	0.1264	0.0104	0.1257
5.00	0.0106	0.1260	0.0112	0.1263	0.0118	0.1262	0.0118	0.1260	0.0118	0.1259
5.50	0.0125	0.1257	0.0134	0.1260	0.0137	0.1260	0.0139	0.1257	0.0141	0.1255
6.00	0.0152	0.1262	0.0155	0.1257	0.0158	0.1256	0.0159	0.1257	0.0156	0.1253
6.50	0.0175	0.1255	0.0179	0.1257	0.0180	0.1254	0.0178	0.1253	0.0174	0.1251
7.00	0.0198	0.1254	0.0204	0.1256	0.0198	0.1253	0.0195	0.1251	0.0188	0.1246

X (in.)	Y = 3.0 in. Mid-Plane (in.)	Thickness (in.)	Y = 3.5 in. Mid-Plane (in.)	Thickness (in.)	Y =4.0 in. Mid-Plane (in.)	Thickness (in.)	Y = 4.5 in. Mid-Plane (in.)	Thickness (in.)
-7.00	0.0223	0.1244	0.0228	0.1244	0.0236	0.1244	0.0244	0.1243
-6.50	0.0201	0.1250	0.0204	0.1248	0.0211	0.1250	0.0213	0.1244
-6.00	0.0170	0.1250	0.0178	0.1251	0.0184	0.1253	0.0191	0.1244
-5.50	0.0150	0.1252	0.0151	0.1250	0.0154	0.1251	0.0162	0.1240
-5.00	0.0128	0.1255	0.0131	0.1258	0.0137	0.1248	0.0137	0.1249
-4.50	0.0108	0.1254	0.0109	0.1259	0.0112	0.1258	0.0114	0.1248
-4.00	0.0091	0.1260	0.0092	0.1261	0.0095	0.1249	0.0098	0.1249
-3.50	0.0076	0.1261	0.0078	0.1261	0.0079	0.1256	0.0081	0.1251
-3.00	0.0063	0.1261	0.0065	0.1261	0.0067	0.1254	0.0059	0.1255
-2.50	0.0053	0.1263	0.0053	0.1261	0.0052	0.1256	0.0046	0.1254
-2.00	0.0040	0.1267	0.0046	0.1263	0.0039	0.1264	0.0040	0.1260
-1.50	0.0033	0.1267	0.0034	0.1260	0.0036	0.1258	0.0030	0.1261
-1.00	0.0026	0.1267	0.0027	0.1265	0.0026	0.1265	0.0021	0.1258
-0.50	0.0023	0.1265	0.0023	0.1264	0.0026	0.1262	0.0020	0.1256
0.00	0.0025	0.1267	0.0025	0.1265	0.0028	0.1263	0.0020	0.1259
0.50	0.0024	0.1264	0.0026	0.1263	0.0028	0.1257	0.0023	0.1261
1.00	0.0030	0.1266	0.0029	0.1265	0.0030	0.1259	0.0026	0.1255
1.50	0.0034	0.1260	0.0037	0.1261	0.0036	0.1259	0.0033	0.1259
2.00	0.0039	0.1261	0.0042	0.1260	0.0044	0.1257	0.0040	0.1257
2.50	0.0049	0.1259	0.0053	0.1258	0.0053	0.1256	0.0048	0.1257
3.00	0.0062	0.1259	0.0062	0.1259	0.0065	0.1258	0.0060	0.1252
3.50	0.0075	0.1259	0.0077	0.1254	0.0077	0.1260	0.0074	0.1257
4.00	0.0089	0.1263	0.0093	0.1256	0.0092	0.1258	0.0090	0.1253
4.50	0.0107	0.1255	0.0109	0.1255	0.0106	0.1249	0.0110	0.1252
5.00	0.0122	0.1258	0.0122	0.1254	0.0123	0.1249	0.0122	0.1247
5.50	0.0139	0.1249	0.0140	0.1250	0.0137	0.1244	0.0139	0.1247
6.00	0.0156	0.1260	0.0155	0.1252	0.0151	0.1248	0.0152	0.1241
6.50	0.0171	0.1249	0.0166	0.1248	0.0158	0.1249	0.0160	0.1238
7.00	0.0178	0.1247	0.0170	0.1246	0.0162	0.1242	0.0150	0.1248

APPENDIX B

THERMAL BUCKLING TESTS RESULTS

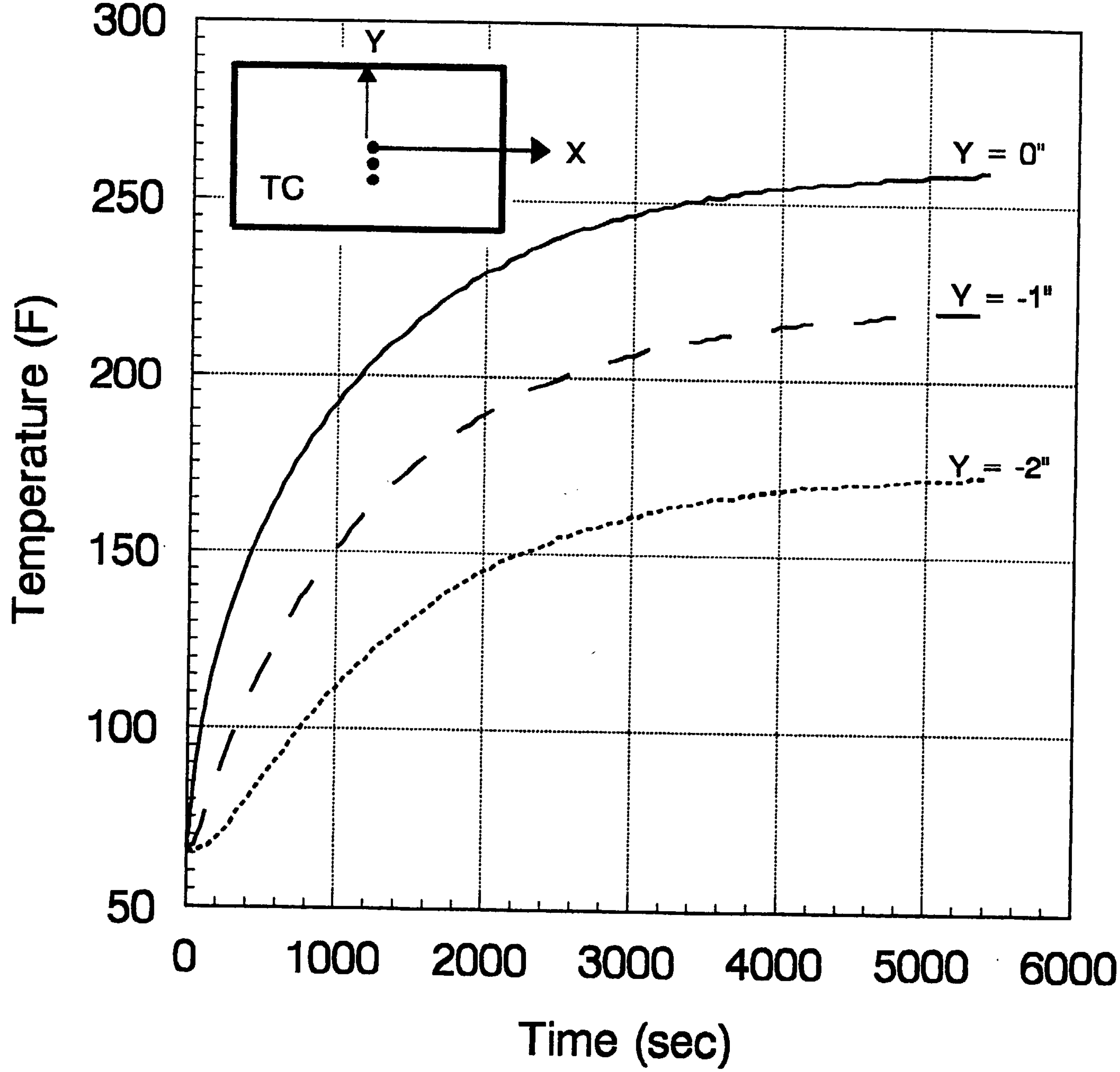
APPENDIX B1

TEST 1 RESULTS

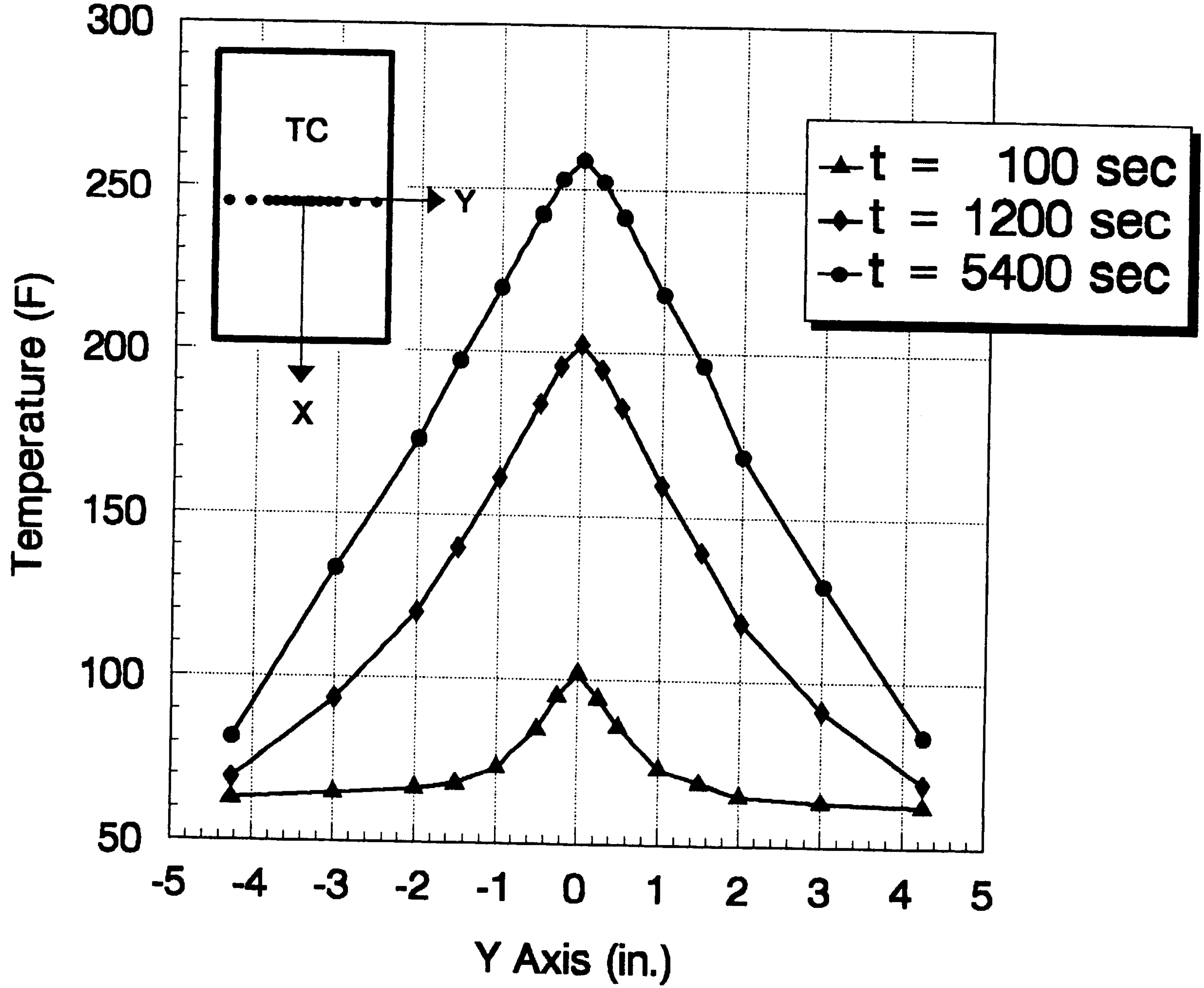
TEST CONDITIONS:

Lamp Power:	5% (.175 Btu/s)
Max Temperature:	250°F
Heat Flux Duration:	5400 s
Behavior:	Elastic

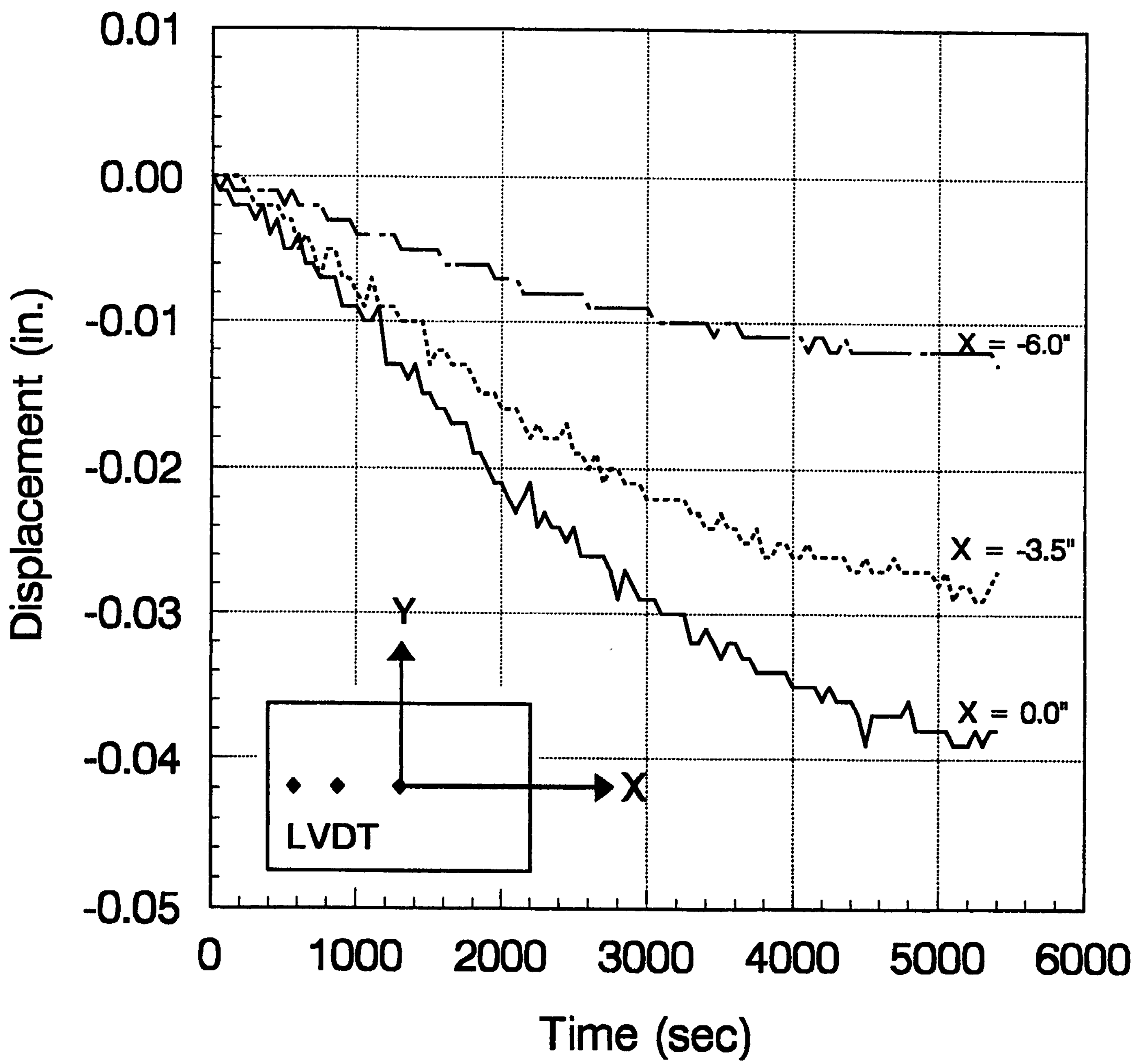
TEST 1 - Panel Temperature History



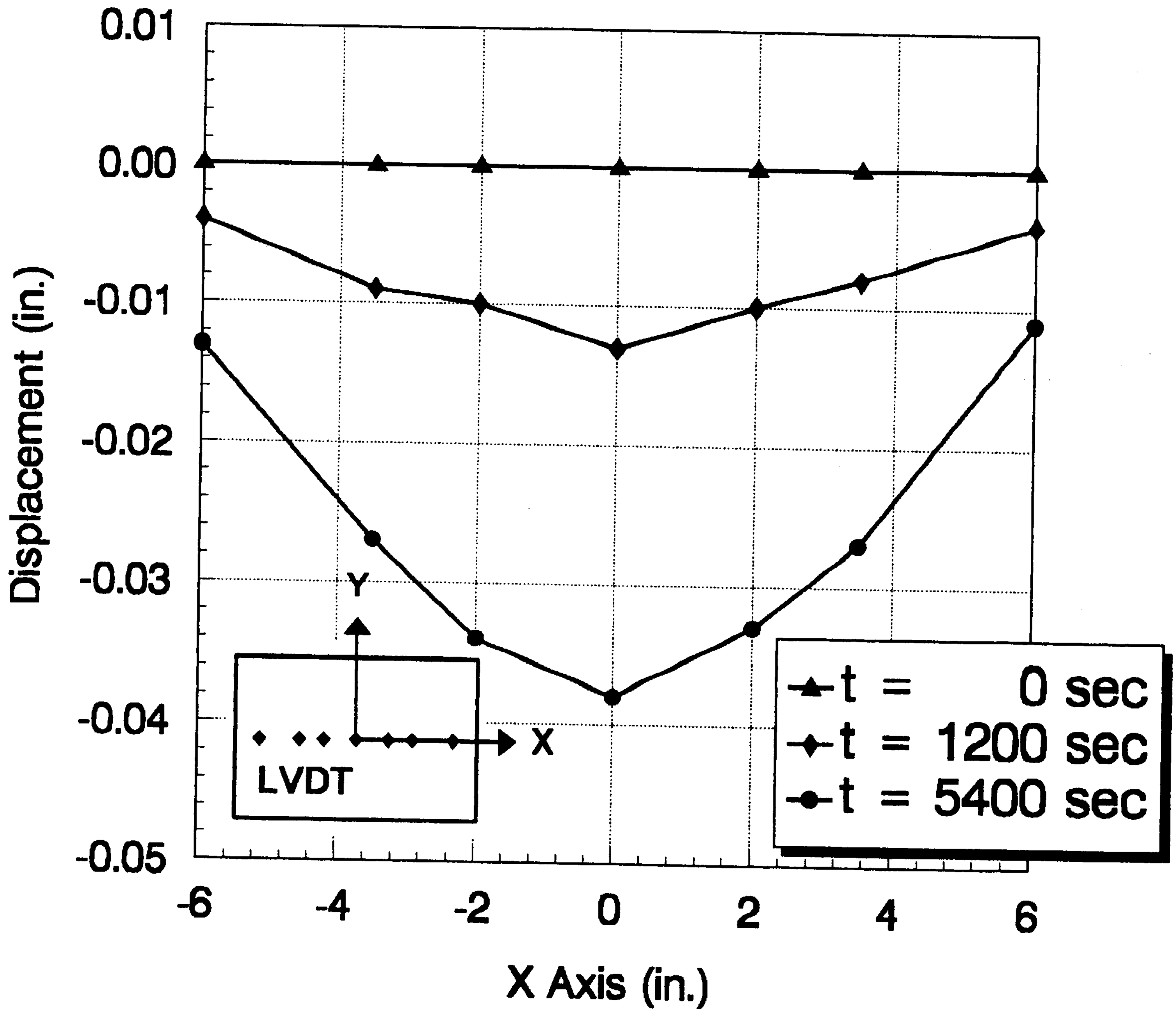
TEST 1 - Panel Temperature Distributions



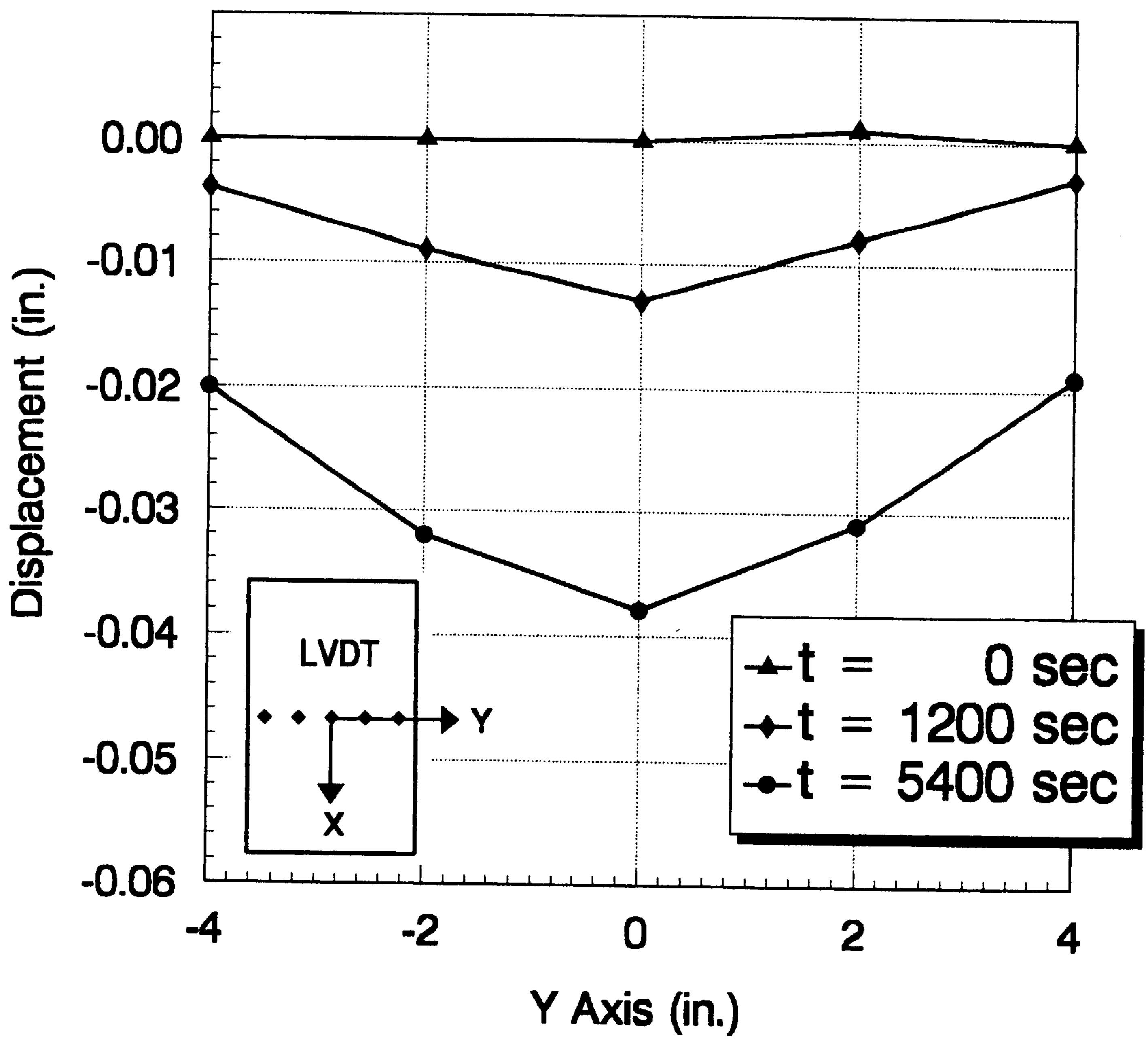
TEST 1 - Panel Displacement History



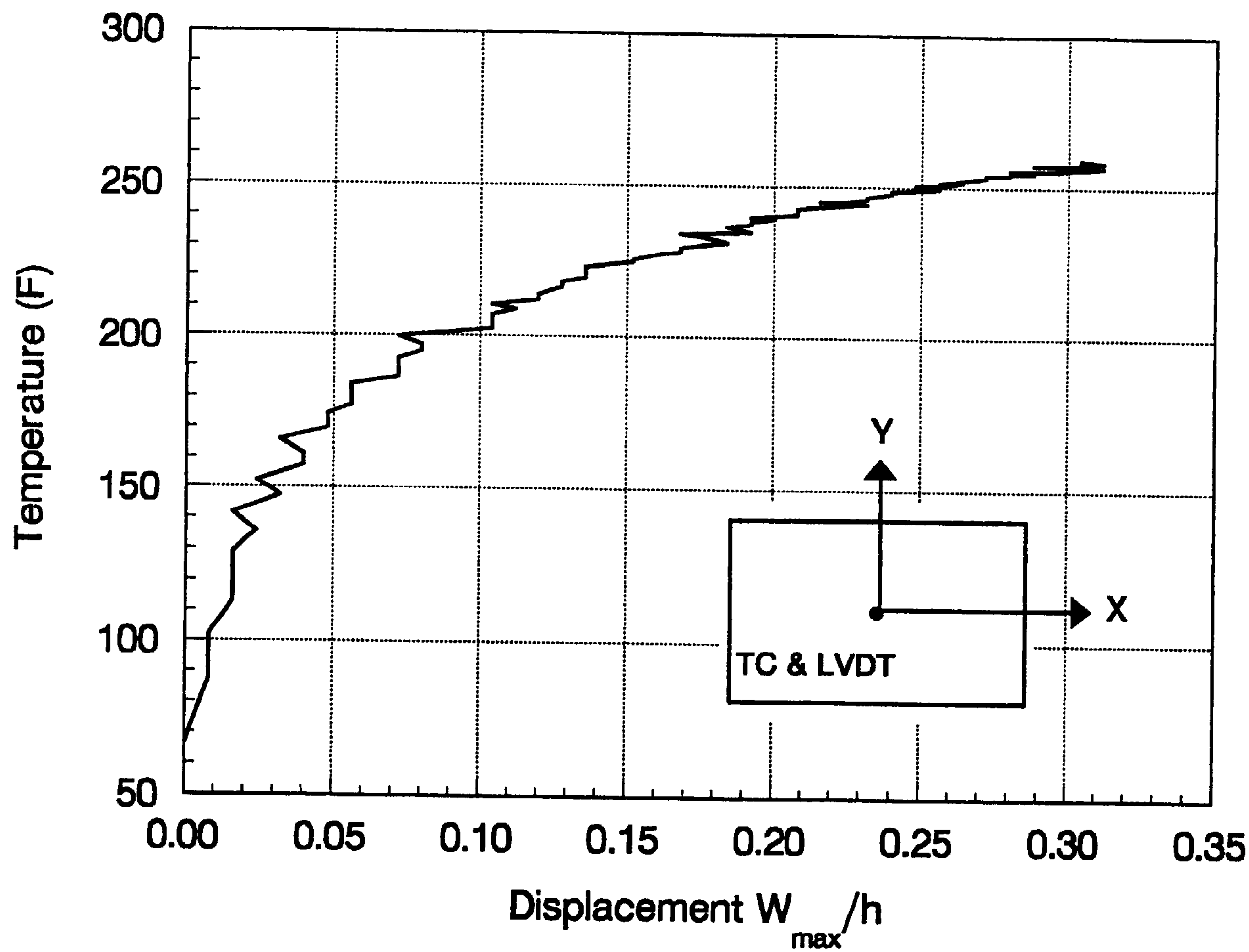
TEST 1 - Panel Displacement Distributions



TEST 1 - Panel Displacement Distributions



TEST 1 - Panel Center Temperature Versus Displacement



SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 5% (92-0128A)
Time is 09:09:03.98.
Date is 1-28-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
0	62	65	66	66	67	67	67	68	67	67	67
100	63	65	66	68	73	85	95	104	104	104	103
200	63	65	69	75	86	103	115	122	122	124	122
300	63	66	74	83	98	116	129	136	136	138	136
400	63	69	80	91	108	128	141	145	147	151	148
500	64	72	86	99	116	138	151	152	157	160	158
600	65	74	91	106	125	147	159	160	164	168	166
700	65	78	97	113	132	155	166	165	171	176	174
800	67	81	102	119	139	161	174	171	176	183	181
900	67	84	107	125	146	168	180	175	182	189	187
1000	67	88	111	130	151	173	186	179	186	194	192
1100	68	91	116	135	157	179	191	182	191	199	198
1200	69	94	120	140	162	184	196	185	195	204	203
1300	71	96	124	144	166	188	201	188	197	208	207
1400	72	99	128	148	170	192	204	191	201	211	211
1500	72	101	131	152	174	197	208	193	204	216	215
1600	72	104	134	156	177	200	211	195	206	219	218
1700	73	106	138	158	181	203	215	197	210	221	221
1800	74	108	140	162	184	206	218	199	211	225	225
1900	74	110	143	164	186	209	221	201	214	227	227
2000	75	111	145	167	189	211	223	201	216	230	230
2100	75	113	148	169	192	214	226	203	218	231	232
2200	76	115	149	172	194	217	228	204	219	234	234
2300	76	116	151	173	197	218	230	206	220	236	237
2400	77	117	152	176	198	220	231	206	222	237	238
2500	77	119	155	177	200	222	234	207	223	238	240
2600	78	120	156	179	201	224	235	208	224	240	242
2700	78	121	157	180	203	225	237	209	226	242	243

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 5%. (92-0128A)
Time is 09:09:03.98.
Date is 1-28-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
2800	78	122	158	182	204	227	238	210	226	243	244
2900	78	123	159	183	206	228	239	210	227	244	245
3000	78	123	161	183	207	229	240	210	227	244	246
3100	79	125	162	185	208	230	241	212	228	245	248
3200	79	125	163	186	209	231	243	212	229	246	249
3300	80	126	164	187	210	233	244	213	229	247	250
3400	80	127	165	188	211	234	245	213	230	248	251
3500	80	127	166	189	212	235	246	213	230	249	252
3600	80	128	166	190	213	235	246	214	231	250	252
3700	80	128	166	190	214	235	247	214	231	250	252
3800	80	129	167	191	214	236	247	215	232	251	253
3900	80	129	168	191	215	236	248	215	232	251	253
4000	81	130	168	192	215	237	249	215	233	252	254
4100	81	130	169	193	215	238	249	215	234	252	255
4200	81	131	169	193	216	239	249	215	234	253	255
4300	81	131	170	194	216	239	250	216	234	253	255
4400	81	131	170	194	217	239	251	216	234	253	256
4500	81	131	171	194	217	240	251	216	234	253	256
4600	81	132	171	195	218	240	251	216	235	253	257
4700	81	132	171	195	219	241	251	216	235	254	257
4800	81	132	172	195	219	241	252	217	235	254	258
4900	81	132	172	195	219	241	253	217	235	254	258
5000	81	132	172	195	220	242	252	217	236	255	258
5100	82	132	172	196	220	242	253	217	237	255	258
5200	82	132	172	196	220	242	253	217	237	255	258
5300	82	132	173	196	220	242	253	218	237	256	258
5400	82	133	173	197	220	242	253	218	236	256	258

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 5% (92-0128A)
Time is 09:09:03.98.
Date is 1-28-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
0	67	67	67	67	67	67	67	67	67	64	63
100	102	101	101	99	103	94	86	73	69	65	63
200	121	120	120	118	121	113	103	85	76	68	64
300	136	134	134	131	134	128	116	96	83	72	65
400	147	146	146	143	145	139	128	107	92	78	67
500	157	156	156	152	153	150	138	116	99	84	69
600	166	163	163	160	160	157	146	123	106	89	73
700	174	172	172	166	166	166	154	131	112	95	76
800	181	178	178	173	172	172	161	138	119	99	79
900	186	185	184	178	176	179	167	144	125	104	83
1000	192	190	189	182	180	185	173	149	130	109	86
1100	197	195	194	186	183	190	178	155	135	113	89
1200	202	199	198	191	186	195	183	160	139	118	91
1300	207	204	202	194	190	199	187	164	143	122	95
1400	211	208	206	197	192	203	192	168	148	124	96
1500	214	211	209	200	194	206	196	172	151	128	99
1600	218	216	212	203	197	211	199	176	155	132	102
1700	221	218	216	205	198	214	202	179	158	133	103
1800	225	220	218	207	201	217	206	182	161	137	106
1900	227	224	221	209	201	220	208	185	163	139	107
2000	230	226	223	211	203	222	211	187	166	141	109
2100	231	228	225	212	204	225	213	190	168	143	111
2200	234	231	226	214	206	226	216	192	171	146	112
2300	237	232	228	216	206	229	217	194	172	147	113
2400	238	234	230	217	208	231	220	197	175	149	114
2500	240	236	231	218	209	233	221	198	177	150	116
2600	242	237	233	219	209	234	223	200	178	152	117
2700	243	239	234	220	210	236	225	201	180	153	118

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 5% (92-0128A)
Time is 09:09:03.98.
Date is 1-28-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
2800	244	240	235	221	211	237	226	202	181	155	119
2900	245	241	237	222	211	238	227	203	182	156	119
3000	246	242	238	223	211	239	228	205	183	156	120
3100	248	244	239	223	213	240	229	206	184	157	121
3200	249	245	239	224	213	242	230	208	186	159	122
3300	250	246	240	225	214	243	232	209	187	160	122
3400	251	246	241	226	214	244	233	209	188	160	123
3500	252	247	242	226	215	244	233	210	189	161	123
3600	251	248	242	227	215	245	234	211	190	162	124
3700	252	248	243	227	215	246	235	212	190	163	125
3800	253	249	243	227	215	246	235	212	190	163	125
3900	254	250	244	228	216	247	236	213	191	164	126
4000	254	251	245	229	216	247	237	214	192	164	126
4100	255	251	245	228	216	248	237	214	192	165	126
4200	255	251	245	228	216	248	237	215	192	166	127
4300	256	252	246	229	216	249	238	215	193	166	127
4400	256	252	246	229	216	249	238	215	193	167	128
4500	257	253	247	230	217	249	239	215	194	167	128
4600	257	253	247	229	217	250	239	215	194	167	128
4700	258	253	247	230	218	250	239	216	195	167	128
4800	258	253	247	230	218	251	240	216	195	167	129
4900	258	253	247	231	218	251	240	217	195	167	129
5000	258	253	247	231	218	251	241	217	195	168	129
5100	258	254	248	231	218	252	241	217	195	168	129
5200	258	254	248	231	219	252	241	218	195	168	129
5300	258	254	248	231	219	252	241	218	196	170	130
5400	259	254	248	231	219	253	242	218	196	169	129

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 5% (92-0128A)
Time is 09:09:03.98.
Date is 1-28-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
0	63	62	62	62	63	65	65	71	55	62	61
100	63	62	62	62	63	73	72	72	54	62	62
200	64	63	63	63	64	86	85	72	54	62	62
300	64	63	63	63	64	98	96	72	58	62	62
400	64	63	63	63	64	108	106	72	55	62	62
500	64	64	64	64	64	118	115	72	58	62	62
600	64	64	64	64	64	126	123	72	58	62	62
700	65	65	65	65	65	132	130	71	57	62	62
800	65	66	66	66	66	140	137	72	60	62	62
900	66	67	67	67	66	146	143	72	56	62	62
1000	67	68	68	68	67	152	148	72	58	62	62
1100	68	69	69	69	68	157	154	72	58	62	62
1200	68	69	69	69	68	162	159	72	59	62	62
1300	69	71	71	71	69	167	164	73	57	63	63
1400	69	71	71	70	69	170	167	72	56	62	62
1500	69	72	72	71	69	174	171	72	60	62	62
1600	70	74	74	73	70	178	176	73	58	63	63
1700	70	74	75	73	69	181	178	72	57	62	62
1800	70	75	75	74	69	184	181	72	56	62	62
1900	70	75	76	75	70	186	184	72	54	62	62
2000	71	76	76	75	70	190	186	72	56	62	62
2100	71	76	77	76	70	192	189	72	59	62	62
2200	72	77	78	76	71	195	191	72	60	62	62
2300	72	78	78	77	71	196	193	73	57	62	62
2400	72	77	78	77	71	198	195	72	60	62	61
2500	72	78	78	77	72	200	197	72	57	62	61
2600	73	79	80	78	72	202	199	73	58	62	62
2700	73	79	80	78	72	203	200	73	54	62	62

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 5% (92-0128A)
Time is 09:09:03.98.
Date is 1-28-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
2800	73	79	80	78	72	205	202	73	58	62	62
2900	73	79	79	78	72	205	203	73	58	62	62
3000	73	79	80	78	72	207	203	72	60	62	62
3100	73	79	80	78	72	208	204	73	58	62	62
3200	73	80	81	79	72	209	206	72	56	62	61
3300	73	80	81	79	73	210	207	73	59	62	62
3400	74	80	81	79	73	211	208	73	55	62	62
3500	73	81	81	79	73	212	208	73	56	62	62
3600	74	81	82	79	73	213	209	73	58	62	62
3700	74	81	82	79	73	213	210	73	59	62	62
3800	74	81	82	79	73	213	211	73	57	62	62
3900	74	81	82	80	73	214	212	73	59	62	62
4000	74	81	82	79	73	215	212	73	59	62	62
4100	74	81	82	80	73	215	213	73	57	62	62
4200	75	81	83	80	73	216	213	73	55	62	62
4300	75	82	83	80	73	216	214	73	55	62	62
4400	75	82	83	80	73	217	214	73	61	62	62
4500	75	82	83	80	73	217	215	73	57	62	62
4600	75	82	83	80	73	218	215	73	56	62	62
4700	76	82	83	80	74	218	215	73	57	62	62
4800	76	82	83	80	74	219	215	73	58	62	62
4900	76	82	83	80	74	219	215	72	54	62	62
5000	76	82	83	81	74	219	216	74	60	62	62
5100	76	82	84	81	74	219	216	74	59	62	62
5200	76	82	84	81	73	219	216	73	57	62	62
5300	77	83	84	82	74	220	218	73	57	62	62
5400	76	83	84	81	73	220	217	73	58	62	62

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 5% (92-0128A)
Time is 09:09:03.98.
Date is 1-28-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	-0.001	0.001	0.000	0.000
200	0.000	0.000	0.000	-0.001	-0.001	0.000	0.000	-0.002	-0.001	-0.001	-0.001
300	0.000	0.000	0.000	0.000	-0.001	-0.002	-0.003	-0.003	-0.002	-0.002	-0.001
400	0.000	-0.001	0.000	-0.002	-0.001	-0.002	-0.002	-0.004	-0.001	-0.002	-0.001
500	-0.001	-0.001	0.000	-0.003	-0.002	-0.003	-0.003	-0.005	-0.004	-0.003	-0.001
600	-0.001	-0.001	0.000	-0.005	-0.002	-0.005	-0.005	-0.004	-0.003	-0.004	-0.002
700	-0.001	-0.001	-0.001	-0.004	-0.002	-0.005	-0.005	-0.006	-0.004	-0.005	-0.002
800	-0.001	-0.002	-0.001	-0.006	-0.003	-0.005	-0.006	-0.007	-0.006	-0.006	-0.003
900	-0.002	-0.003	-0.002	-0.006	-0.003	-0.007	-0.008	-0.009	-0.007	-0.006	-0.003
1000	-0.002	-0.003	-0.002	-0.008	-0.004	-0.008	-0.010	-0.009	-0.008	-0.007	-0.003
1100	-0.002	-0.003	-0.002	-0.008	-0.004	-0.007	-0.010	-0.010	-0.007	-0.007	-0.003
1200	-0.003	-0.004	-0.002	-0.009	-0.004	-0.009	-0.010	-0.013	-0.010	-0.008	-0.004
1300	-0.004	-0.005	-0.003	-0.009	-0.005	-0.010	-0.012	-0.013	-0.010	-0.009	-0.004
1400	-0.004	-0.005	-0.003	-0.011	-0.005	-0.010	-0.013	-0.013	-0.011	-0.010	-0.005
1500	-0.004	-0.006	-0.004	-0.012	-0.005	-0.013	-0.014	-0.015	-0.012	-0.010	-0.005
1600	-0.005	-0.006	-0.004	-0.012	-0.006	-0.012	-0.014	-0.016	-0.014	-0.011	-0.005
1700	-0.005	-0.007	-0.004	-0.014	-0.006	-0.013	-0.015	-0.017	-0.014	-0.012	-0.005
1800	-0.005	-0.008	-0.005	-0.015	-0.006	-0.014	-0.017	-0.019	-0.016	-0.013	-0.006
1900	-0.006	-0.008	-0.005	-0.016	-0.006	-0.015	-0.016	-0.020	-0.017	-0.013	-0.006
2000	-0.007	-0.009	-0.005	-0.016	-0.007	-0.016	-0.017	-0.021	-0.018	-0.015	-0.007
2100	-0.007	-0.009	-0.006	-0.019	-0.007	-0.016	-0.020	-0.023	-0.017	-0.015	-0.007
2200	-0.007	-0.010	-0.007	-0.019	-0.008	-0.018	-0.019	-0.021	-0.020	-0.016	-0.007
2300	-0.008	-0.010	-0.007	-0.020	-0.008	-0.018	-0.021	-0.023	-0.020	-0.016	-0.007
2400	-0.009	-0.011	-0.007	-0.019	-0.008	-0.018	-0.022	-0.024	-0.021	-0.017	-0.008
2500	-0.009	-0.012	-0.007	-0.021	-0.008	-0.019	-0.023	-0.024	-0.024	-0.017	-0.008
2600	-0.009	-0.012	-0.007	-0.021	-0.009	-0.020	-0.023	-0.026	-0.023	-0.018	-0.008
2700	-0.009	-0.012	-0.008	-0.022	-0.009	-0.021	-0.024	-0.026	-0.024	-0.018	-0.008

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 5% (92-0128A)
Time is 09:09:03.98.
Date is 1-28-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
2800	-0.010	-0.013	-0.008	-0.023	-0.009	-0.020	-0.024	-0.029	-0.023	-0.019	-0.008
2900	-0.010	-0.014	-0.009	-0.023	-0.009	-0.021	-0.024	-0.028	-0.025	-0.019	-0.009
3000	-0.010	-0.014	-0.009	-0.025	-0.009	-0.022	-0.027	-0.029	-0.024	-0.020	-0.009
3100	-0.010	-0.014	-0.009	-0.024	-0.010	-0.022	-0.027	-0.030	-0.025	-0.020	-0.009
3200	-0.011	-0.015	-0.009	-0.024	-0.010	-0.022	-0.026	-0.030	-0.027	-0.021	-0.009
3300	-0.011	-0.015	-0.010	-0.026	-0.010	-0.023	-0.028	-0.032	-0.027	-0.022	-0.009
3400	-0.011	-0.015	-0.010	-0.026	-0.010	-0.024	-0.027	-0.031	-0.027	-0.022	-0.009
3500	-0.012	-0.016	-0.010	-0.027	-0.010	-0.023	-0.028	-0.033	-0.027	-0.022	-0.010
3600	-0.012	-0.016	-0.010	-0.027	-0.010	-0.024	-0.029	-0.032	-0.029	-0.022	-0.010
3700	-0.011	-0.016	-0.010	-0.027	-0.011	-0.025	-0.030	-0.033	-0.026	-0.023	-0.010
3800	-0.012	-0.016	-0.011	-0.028	-0.011	-0.026	-0.030	-0.034	-0.029	-0.023	-0.010
3900	-0.012	-0.017	-0.011	-0.028	-0.011	-0.025	-0.030	-0.034	-0.030	-0.024	-0.010
4000	-0.013	-0.017	-0.011	-0.028	-0.011	-0.026	-0.030	-0.035	-0.030	-0.024	-0.010
4100	-0.013	-0.017	-0.011	-0.028	-0.012	-0.025	-0.031	-0.035	-0.030	-0.024	-0.010
4200	-0.013	-0.018	-0.011	-0.029	-0.011	-0.026	-0.031	-0.036	-0.030	-0.025	-0.010
4300	-0.013	-0.018	-0.012	-0.030	-0.012	-0.026	-0.031	-0.036	-0.032	-0.024	-0.010
4400	-0.013	-0.018	-0.012	-0.030	-0.012	-0.027	-0.031	-0.036	-0.031	-0.025	-0.011
4500	-0.014	-0.018	-0.012	-0.029	-0.012	-0.026	-0.032	-0.039	-0.031	-0.025	-0.010
4600	-0.013	-0.018	-0.012	-0.031	-0.012	-0.027	-0.032	-0.037	-0.031	-0.025	-0.011
4700	-0.013	-0.018	-0.012	-0.031	-0.012	-0.026	-0.033	-0.037	-0.032	-0.025	-0.011
4800	-0.014	-0.018	-0.012	-0.031	-0.012	-0.027	-0.033	-0.036	-0.031	-0.025	-0.011
4900	-0.014	-0.018	-0.012	-0.031	-0.012	-0.027	-0.033	-0.038	-0.032	-0.025	-0.011
5000	-0.014	-0.019	-0.013	-0.031	-0.012	-0.028	-0.033	-0.038	-0.032	-0.026	-0.011
5100	-0.014	-0.019	-0.013	-0.032	-0.012	-0.029	-0.033	-0.039	-0.033	-0.026	-0.011
5200	-0.014	-0.019	-0.013	-0.031	-0.012	-0.028	-0.033	-0.039	-0.033	-0.026	-0.011
5300	-0.014	-0.019	-0.013	-0.032	-0.012	-0.029	-0.033	-0.039	-0.033	-0.026	-0.011
5400	-0.014	-0.020	-0.013	-0.032	-0.013	-0.027	-0.034	-0.038	-0.033	-0.027	-0.011

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 5% (92-0128A)
Time is 09:09:03.98.
Date is 1-28-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
0	0.001	0.000	0.000	0.000
100	-0.001	0.000	0.000	0.000
200	-0.001	0.000	0.000	0.000
300	-0.001	0.000	0.000	0.000
400	-0.002	0.000	0.000	0.000
500	-0.003	0.000	0.000	0.000
600	-0.003	0.000	-0.001	0.000
700	-0.005	-0.001	-0.001	0.000
800	-0.006	-0.001	-0.001	-0.001
900	-0.006	-0.001	-0.002	-0.001
1000	-0.008	-0.002	-0.002	-0.001
1100	-0.007	-0.002	-0.003	-0.002
1200	-0.008	-0.002	-0.003	-0.002
1300	-0.009	-0.003	-0.004	-0.002
1400	-0.011	-0.003	-0.004	-0.003
1500	-0.011	-0.004	-0.005	-0.003
1600	-0.012	-0.004	-0.006	-0.003
1700	-0.013	-0.004	-0.006	-0.004
1800	-0.014	-0.005	-0.007	-0.004
1900	-0.015	-0.006	-0.007	-0.004
2000	-0.016	-0.005	-0.008	-0.004
2100	-0.017	-0.006	-0.009	-0.005
2200	-0.018	-0.006	-0.009	-0.005
2300	-0.019	-0.007	-0.010	-0.006
2400	-0.019	-0.007	-0.010	-0.006
2500	-0.020	-0.008	-0.011	-0.006
2600	-0.019	-0.008	-0.011	-0.007
2700	-0.022	-0.008	-0.011	-0.007

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 5% (92-0128A)
Time is 09:09:03.98.
Date is 1-28-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
2800	-0.021	-0.008	-0.012	-0.007
2900	-0.022	-0.009	-0.012	-0.007
3000	-0.023	-0.009	-0.013	-0.008
3100	-0.023	-0.010	-0.013	-0.008
3200	-0.025	-0.009	-0.014	-0.008
3300	-0.025	-0.010	-0.014	-0.008
3400	-0.025	-0.010	-0.014	-0.008
3500	-0.025	-0.010	-0.015	-0.009
3600	-0.026	-0.010	-0.015	-0.009
3700	-0.027	-0.011	-0.015	-0.009
3800	-0.027	-0.011	-0.016	-0.009
3900	-0.027	-0.011	-0.016	-0.010
4000	-0.028	-0.011	-0.016	-0.010
4100	-0.028	-0.011	-0.016	-0.010
4200	-0.029	-0.011	-0.016	-0.010
4300	-0.028	-0.012	-0.017	-0.010
4400	-0.028	-0.012	-0.017	-0.010
4500	-0.029	-0.012	-0.017	-0.011
4600	-0.030	-0.012	-0.017	-0.011
4700	-0.030	-0.012	-0.017	-0.011
4800	-0.030	-0.012	-0.017	-0.011
4900	-0.030	-0.012	-0.017	-0.011
5000	-0.029	-0.012	-0.018	-0.011
5100	-0.031	-0.013	-0.018	-0.011
5200	-0.031	-0.013	-0.019	-0.011
5300	-0.031	-0.013	-0.018	-0.011
5400	-0.031	-0.013	-0.019	-0.012

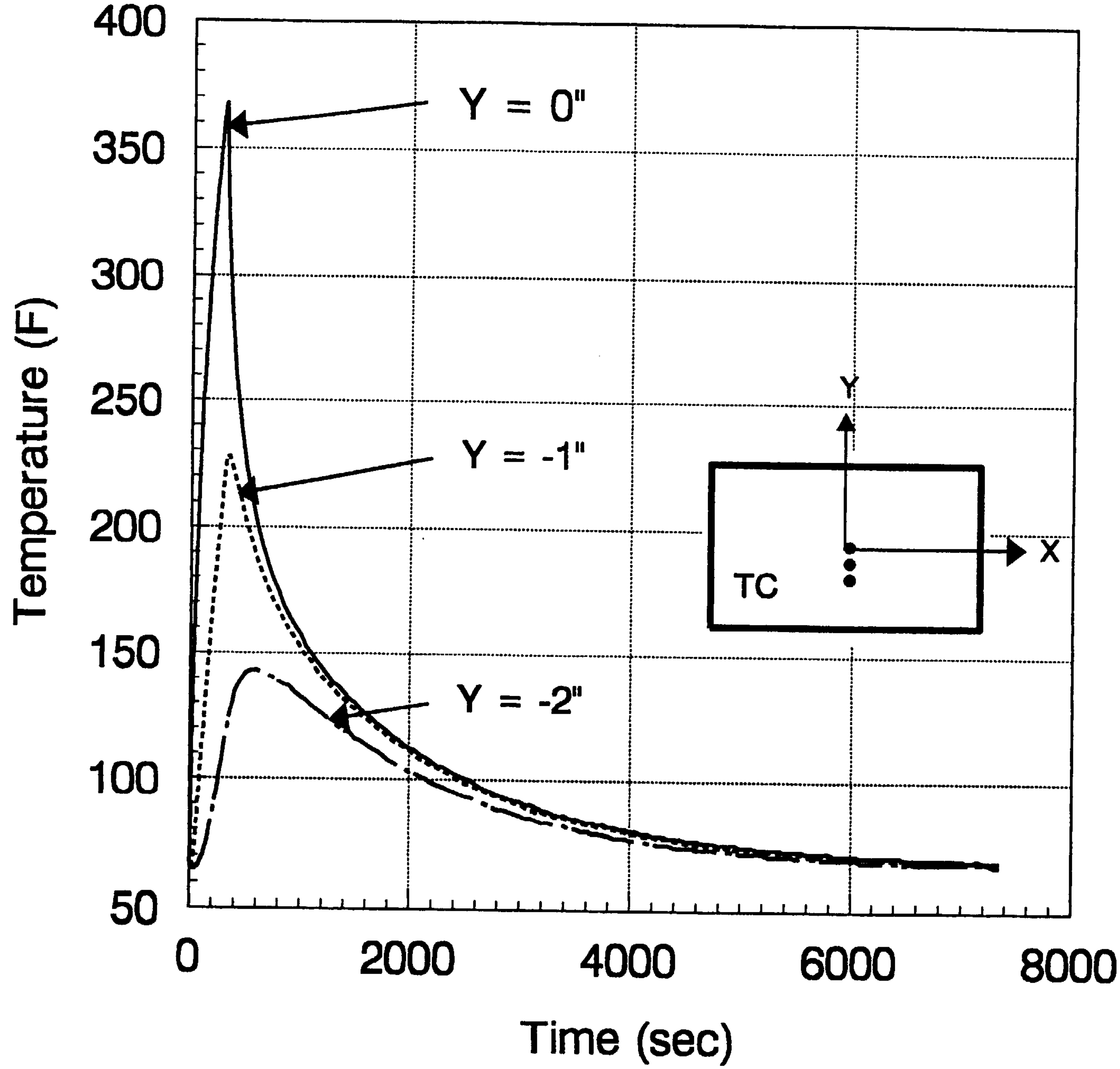
APPENDIX B2

TEST 2 RESULTS

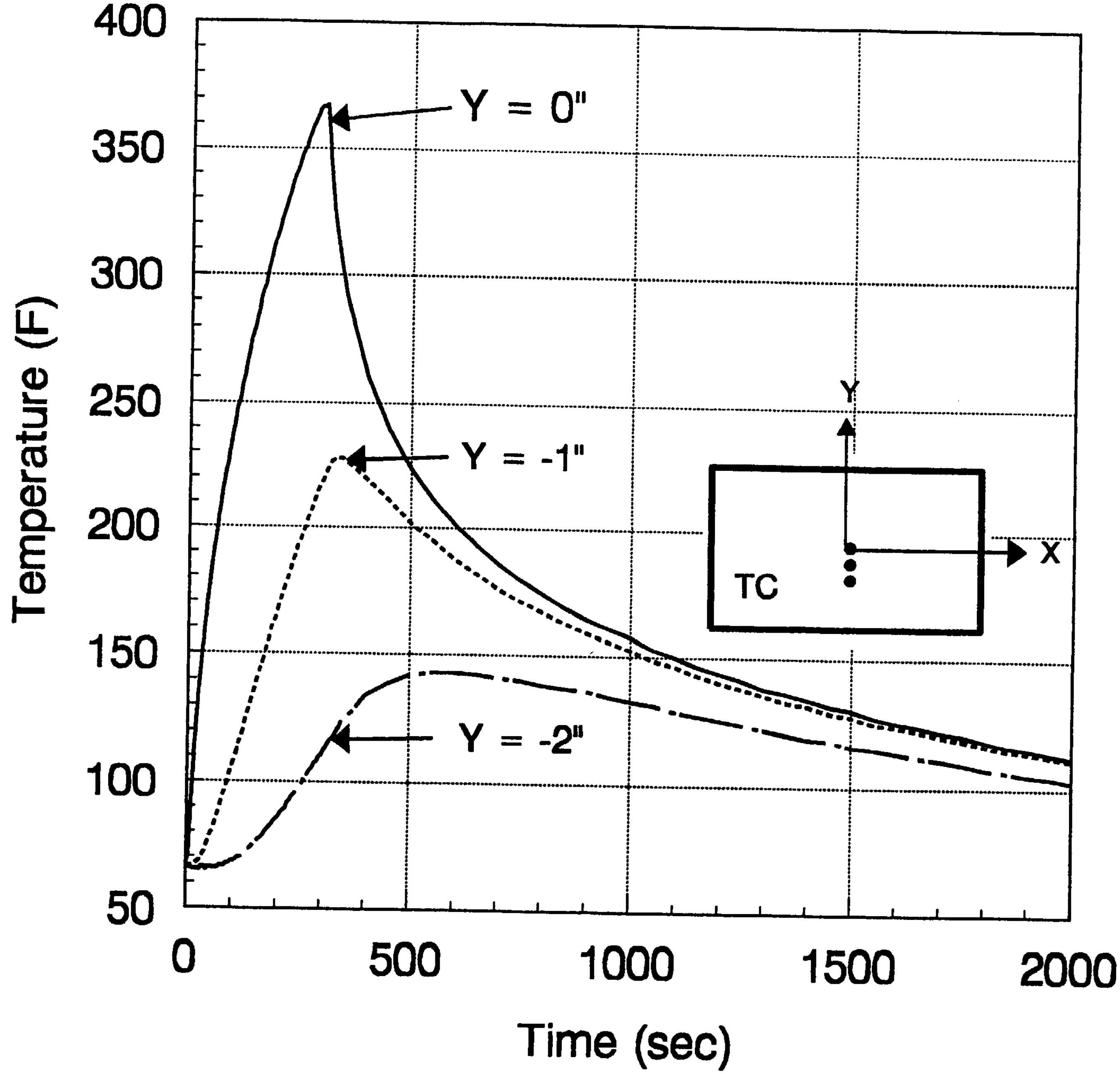
TEST CONDITIONS:

Lamp Power:	15% (.64 Btu/s)
Max Temperature:	375°F
Heat Flux Duration:	300 s
Behavior:	Elastic

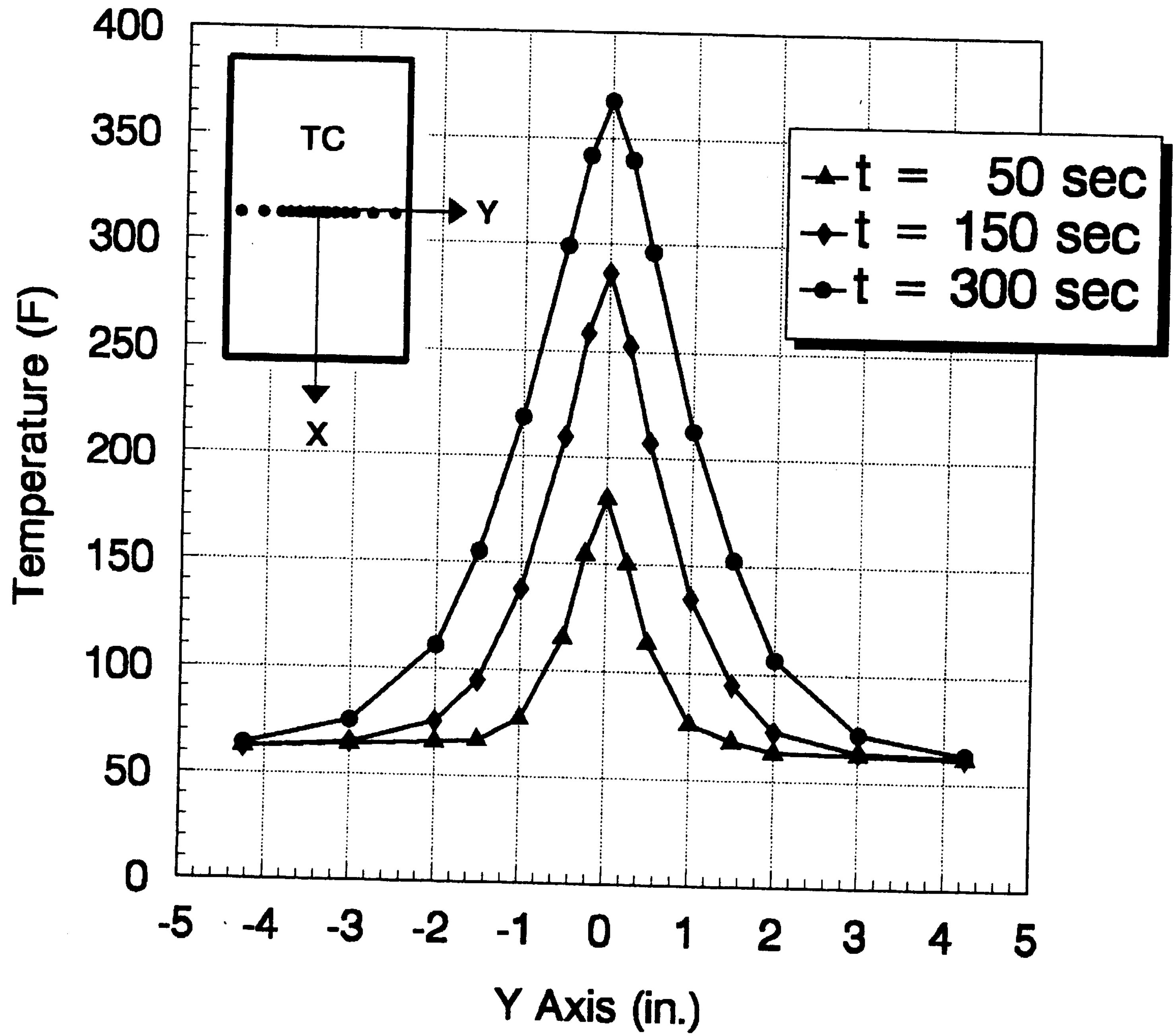
TEST 2 - Panel Temperature History



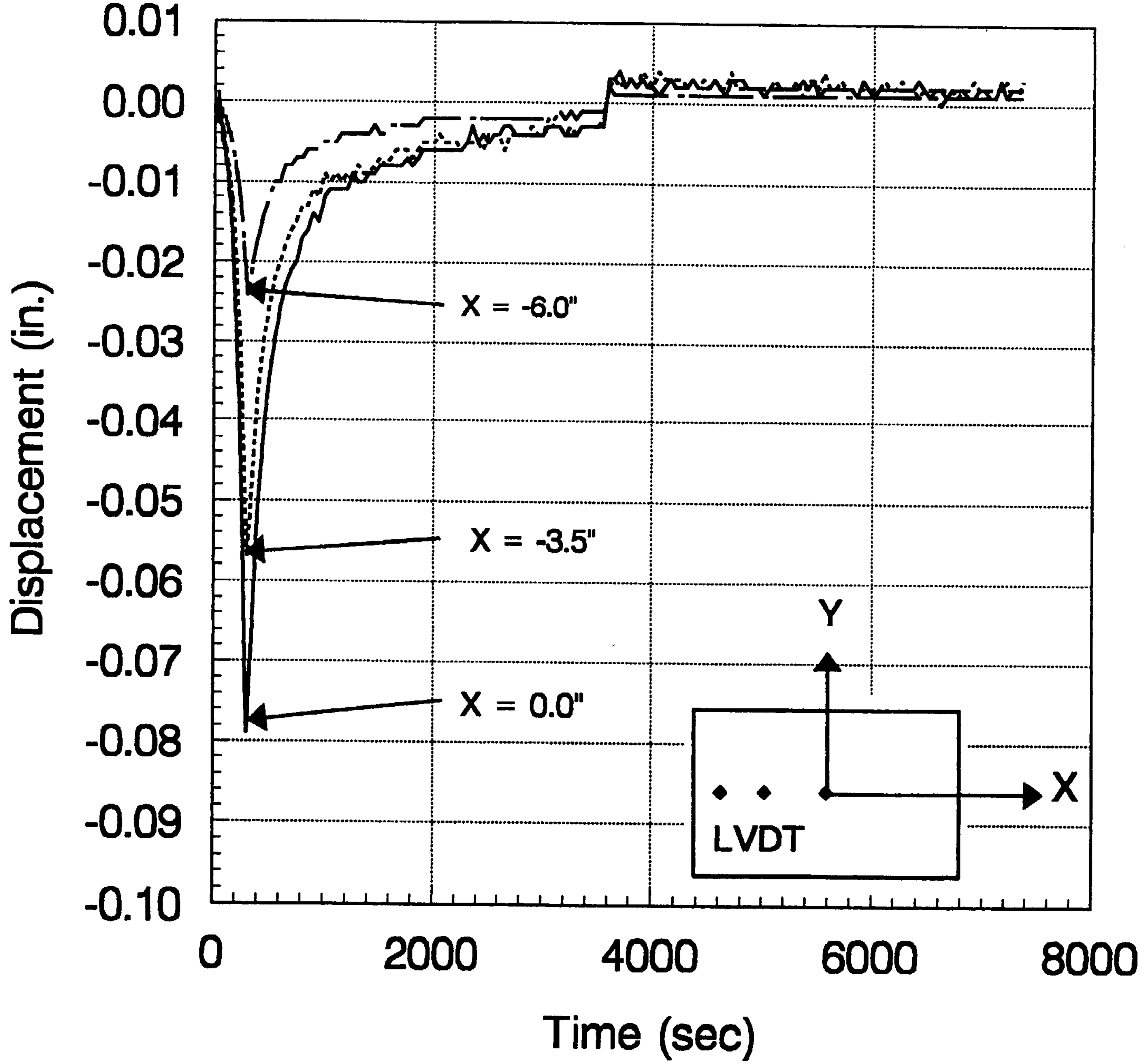
TEST 2 - Panel Temperature History

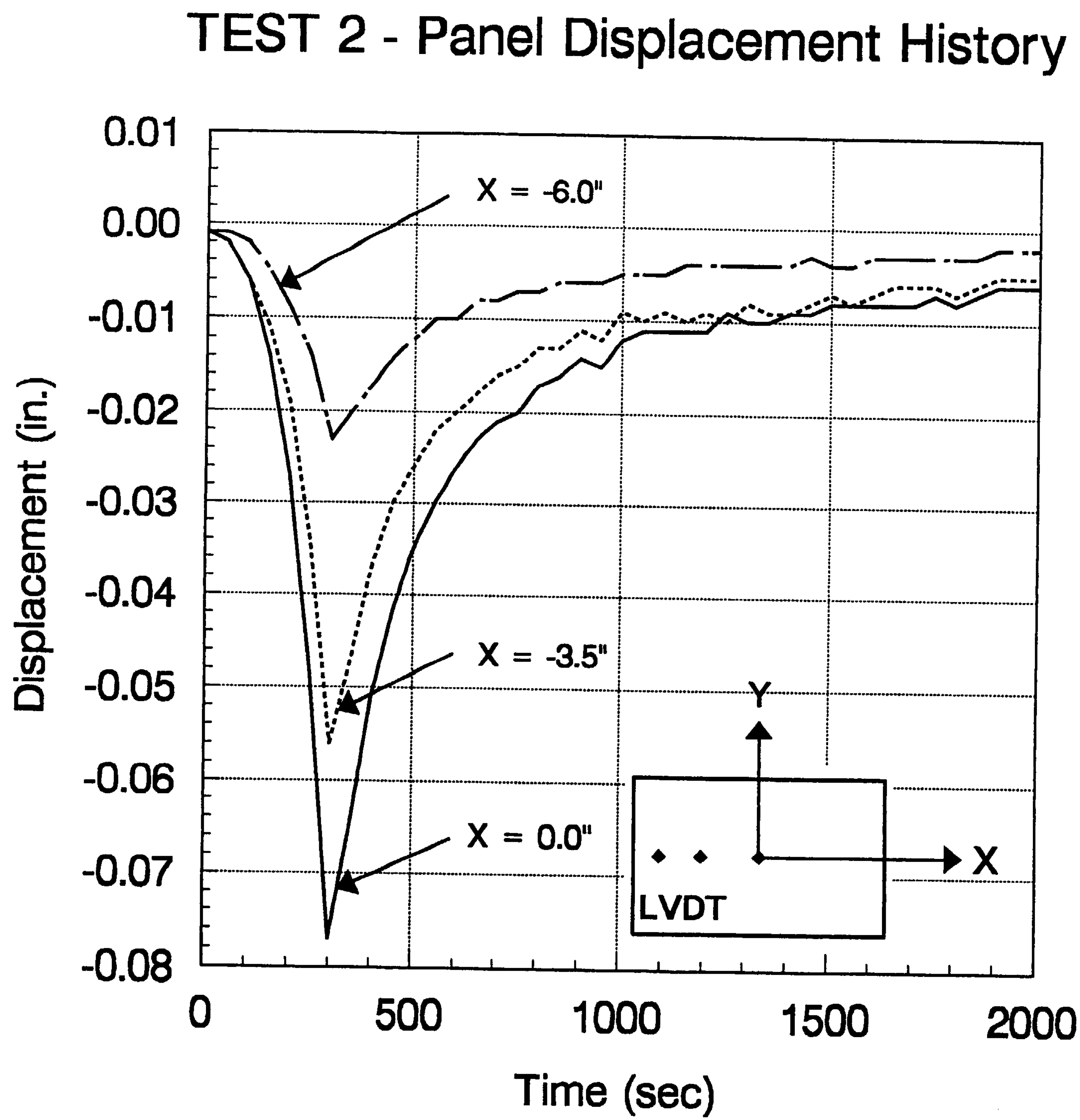


TEST 2 - Panel Temperature Distributions

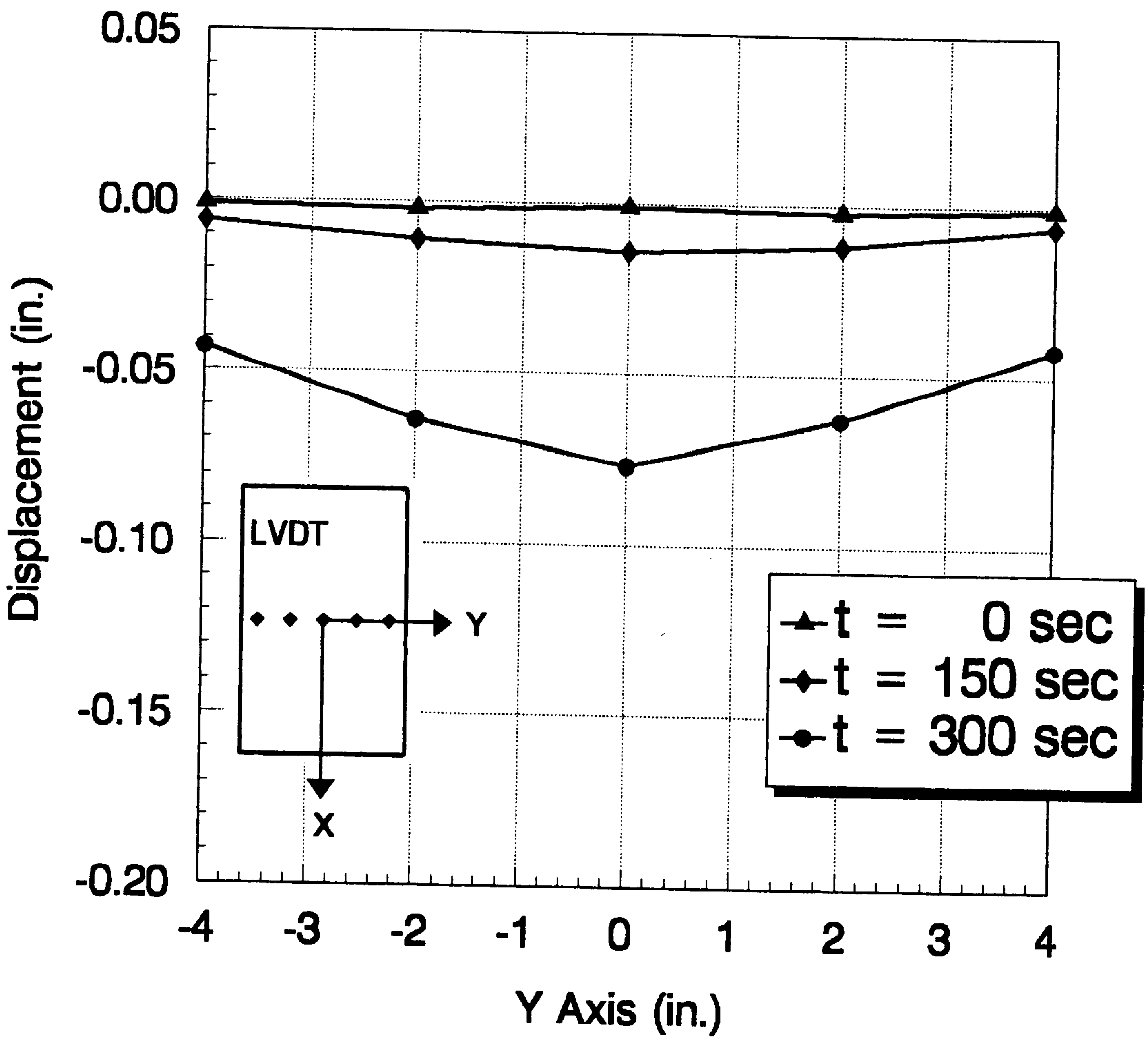


TEST 2 - Panel Displacement History

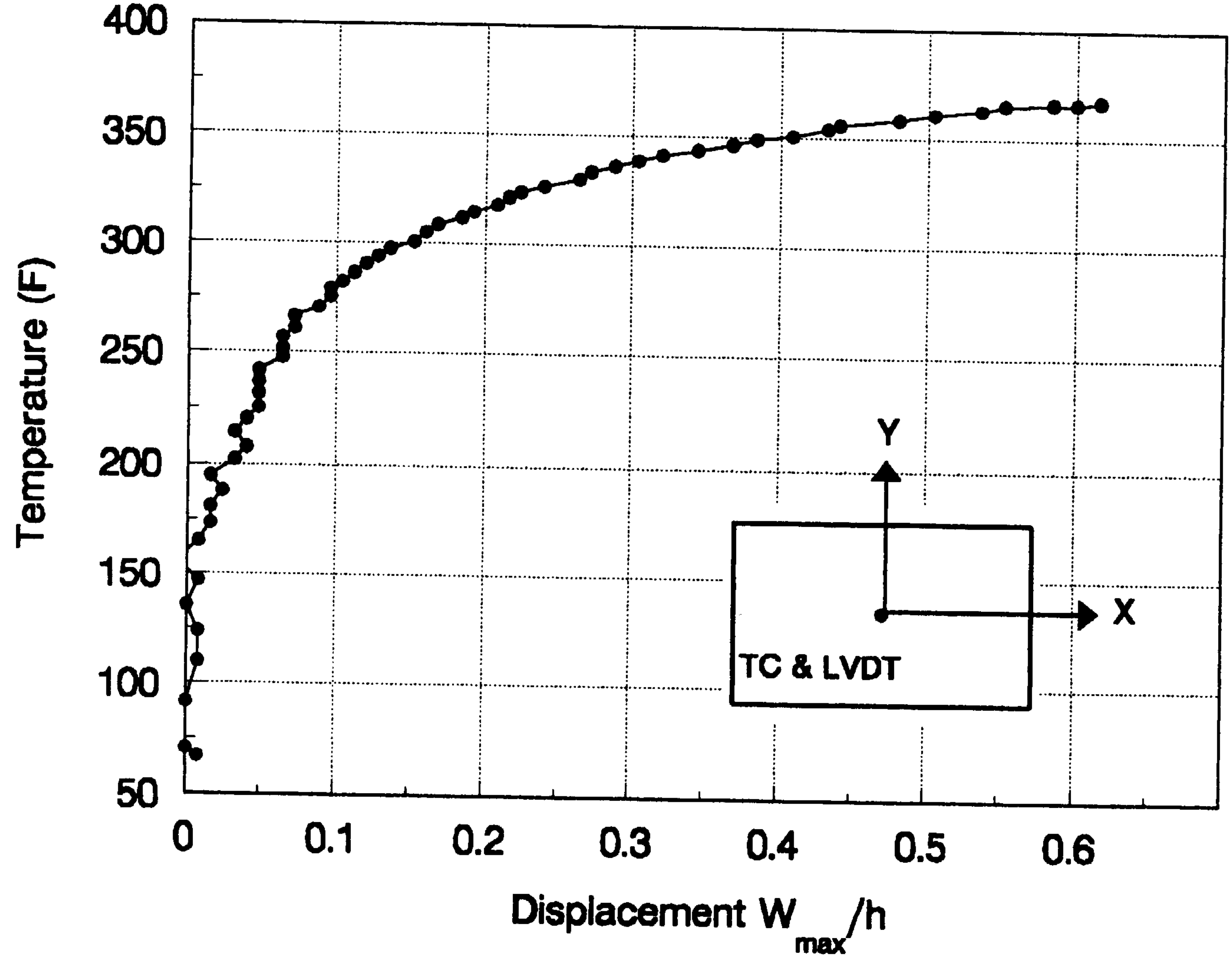


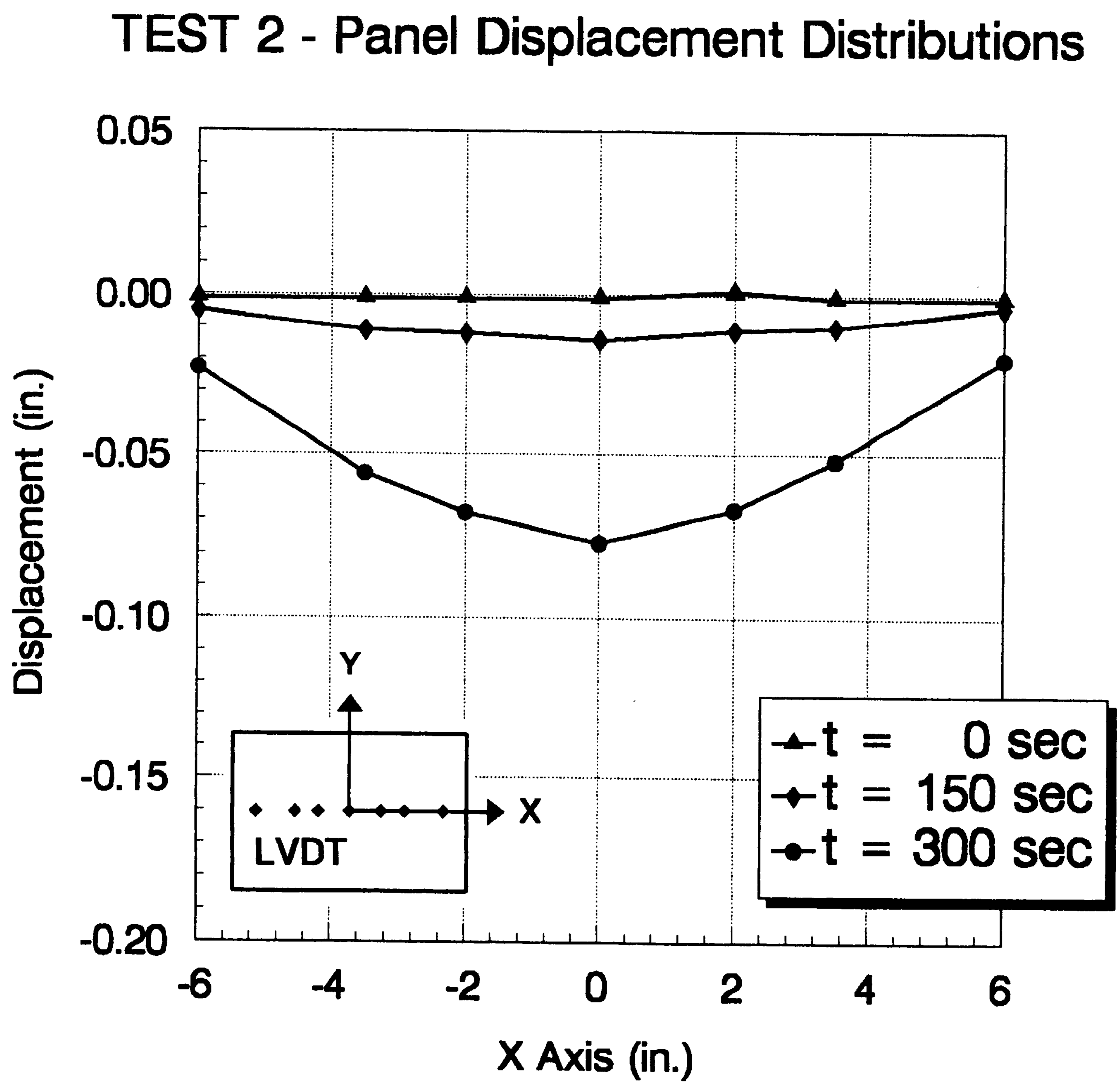

TEST 2 - Panel Displacement History
Displacement (in.)
0.01
0.00
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
-0.08
0
500
1000
1500
2000
Time (sec)
X = -6.0"
X = -3.5"
X = 0.0"
Y
X
LVDT

TEST 2 - Panel Displacement Distributions



TEST 2 - Panel Center Temperature Versus Displacement





TEST 2 - Panel Displacement Distributions
0.05
0.00
-0.05
-0.10
-0.15
-0.20
Displacement (in.)
-6
-4
-2
0
2
4
6
X Axis (in.)
Y
X
LVDT
t = 0 sec
t = 150 sec
t = 300 sec

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
0	63	65	66	66	66	67	67	67	67	67	67
10	63	65	66	66	66	69	80	91	93	93	92
20	63	64	65	66	67	78	102	123	125	126	125
30	63	64	65	66	69	91	122	146	149	150	148
40	63	64	66	66	72	103	139	166	168	170	167
50	62	64	66	67	77	115	154	182	185	186	183
60	62	64	66	68	82	127	167	196	199	201	196
70	62	64	66	70	88	137	179	210	212	214	210
80	62	64	67	72	94	147	191	223	224	226	222
90	62	64	68	74	100	157	202	234	237	238	234
100	62	64	68	78	107	167	213	245	247	249	244
110	62	65	69	81	112	177	222	254	257	259	254
120	62	64	70	84	118	185	232	264	266	269	264
130	62	64	72	88	125	194	242	272	275	278	274
140	62	65	73	91	132	202	250	280	284	286	281
150	62	65	75	95	138	210	258	288	291	294	289
160	62	65	77	99	143	217	266	296	299	302	297
170	62	66	79	102	149	225	273	302	307	309	304
180	62	66	81	107	156	232	281	309	314	316	311
190	62	66	83	111	162	239	287	315	321	324	318
200	62	67	85	114	167	246	294	322	327	330	324
210	62	68	88	118	173	253	300	328	332	336	330
220	62	68	90	123	178	258	306	334	339	342	336
230	63	69	93	127	184	265	312	339	345	348	341
240	63	70	95	131	189	271	317	345	350	354	346
250	63	70	98	136	194	276	323	350	355	359	352
260	63	71	100	139	199	282	329	355	361	365	356
270	63	71	103	143	204	287	333	360	366	370	361

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
280	64	73	105	147	210	291	337	364	371	374	366
290	63	73	108	151	215	296	341	369	375	378	369
300	64	75	111	155	219	299	342	373	378	380	370
400	66	86	134	176	219	250	258	245	257	264	260
500	68	97	142	174	202	219	223	203	218	225	223
600	70	104	143	168	187	199	201	178	193	203	201
700	72	108	141	161	176	184	185	161	176	187	186
800	74	109	139	156	167	173	174	149	164	175	175
900	75	110	137	150	159	164	165	139	153	165	165
1000	75	109	133	144	152	156	157	132	144	156	157
1200	74	106	126	135	140	143	144	119	131	142	144
1400	73	102	119	127	132	133	133	111	121	132	134
1600	73	98	114	120	124	125	125	104	113	123	125
1800	72	95	108	114	117	119	119	98	106	115	119
2000	71	91	103	108	111	112	112	94	101	110	112
2200	70	89	99	103	105	107	107	91	97	104	107
2400	69	85	95	99	101	102	102	89	93	100	102
2600	68	84	92	95	97	98	98	85	90	96	98
2800	68	81	89	91	94	94	94	84	87	92	94
3000	68	80	86	89	91	92	92	82	85	89	92
3200	67	78	84	86	88	89	89	80	83	87	89
3400	67	76	82	84	86	86	87	79	82	85	87
3600	66	74	80	82	83	84	84	78	80	82	84
3800	66	73	79	80	81	82	82	77	79	80	82
4000	66	73	77	79	80	80	80	76	77	80	80
4200	65	72	76	77	79	79	79	75	76	78	79
4400	65	71	74	76	77	77	77	74	75	77	78
4600	65	70	73	75	75	76	76	74	74	76	76

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
4800	65	70	73	73	74	75	75	73	73	75	75
5000	64	69	72	73	74	75	75	73	74	75	75
5200	64	69	72	72	73	74	74	73	73	74	74
5400	64	69	71	72	72	73	73	72	73	73	73
5600	64	68	71	71	71	72	72	72	72	72	72
5800	64	68	70	71	71	71	71	71	71	71	72
6000	64	67	70	71	71	71	71	71	71	71	71
6200	64	67	69	70	70	71	71	71	71	71	71
6400	64	67	69	70	70	70	70	71	71	71	71
6600	64	67	68	69	70	70	70	71	71	70	70
6800	64	67	68	69	69	69	70	71	70	70	70
7000	63	67	69	69	69	69	69	70	70	70	70
7200	63	67	69	69	69	69	69	71	70	70	69

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
0	67	67	67	68	68	68	68	68	68	64	64
10	92	91	91	89	94	78	69	68	67	63	63
20	124	122	121	119	125	100	78	68	67	63	63
30	147	143	143	140	148	119	91	69	68	63	62
40	165	162	162	158	165	135	102	72	68	64	63
50	181	176	177	172	181	150	113	76	68	64	63
60	195	190	191	186	195	163	125	81	69	64	63
70	208	203	204	198	207	176	136	87	71	64	63
80	220	215	215	210	219	188	147	92	73	64	63
90	231	226	226	219	229	198	156	98	75	66	63
100	242	236	237	229	240	209	165	104	78	66	63
110	252	246	246	238	249	219	175	110	81	67	63
120	261	255	255	247	258	228	183	117	85	68	64
130	270	264	264	255	267	237	192	122	87	69	63
140	279	272	272	264	274	245	200	129	90	71	64
150	286	279	279	271	282	253	207	134	95	73	64
160	294	287	286	278	291	260	214	139	98	75	64
170	301	294	293	285	297	268	221	146	102	77	64
180	309	301	300	291	303	274	229	151	106	78	65
190	314	308	307	298	309	281	236	157	110	81	65
200	321	314	313	304	316	288	242	163	113	83	65
210	327	320	318	309	322	294	248	168	118	84	66
220	333	326	324	315	327	300	254	173	121	87	66
230	339	331	330	321	334	307	261	179	125	89	67
240	344	336	335	327	339	312	266	184	130	91	68
250	349	341	341	331	344	318	272	190	133	94	68
260	354	346	345	336	349	323	277	194	137	96	68
270	359	352	350	341	354	328	282	199	141	99	69

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
280	363	356	355	346	360	333	288	204	145	101	71
290	367	360	358	351	364	337	293	209	149	104	72
300	368	361	361	355	369	340	296	213	152	106	73
400	260	256	254	248	245	258	249	217	175	128	83
500	223	220	218	211	204	223	219	200	174	137	93
600	201	199	196	188	179	201	199	187	168	139	100
700	186	183	180	172	162	186	184	176	162	138	104
800	175	171	169	160	150	175	173	167	156	135	106
900	165	162	160	151	140	165	164	159	151	133	107
1000	157	155	152	143	133	157	157	152	146	130	106
1200	144	142	139	130	120	144	144	141	136	123	104
1400	134	132	129	120	112	134	134	132	128	116	100
1600	125	124	120	112	105	126	126	125	120	111	96
1800	119	117	114	106	99	119	119	118	114	105	93
2000	112	111	108	100	95	113	112	111	109	102	90
2200	107	105	103	96	91	107	107	106	104	97	87
2400	102	101	98	93	89	103	103	102	100	93	84
2600	98	97	95	90	86	99	99	98	96	90	82
2800	94	94	91	87	84	94	94	94	93	87	80
3000	92	91	89	85	82	92	92	92	90	84	78
3200	89	88	86	83	80	89	89	89	87	82	77
3400	87	86	84	82	79	87	87	87	85	80	75
3600	84	84	82	80	78	85	85	84	83	79	74
3800	82	81	80	78	77	82	83	82	81	77	73
4000	80	80	79	77	76	80	80	80	80	77	71
4200	79	79	78	76	75	79	80	79	78	75	71
4400	78	78	76	75	74	78	78	78	77	74	69
4600	77	76	75	74	74	77	77	76	76	72	69

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
4800	75	75	74	73	73	75	76	75	75	72	69
5000	75	75	74	73	73	75	75	75	74	71	68
5200	74	74	73	73	72	74	74	74	74	70	67
5400	73	73	73	72	72	74	74	73	73	69	67
5600	72	72	72	71	71	73	72	72	72	68	67
5800	72	72	71	71	71	72	72	72	71	68	66
6000	71	71	71	71	71	71	71	71	71	68	66
6200	71	71	71	71	71	71	71	71	71	68	66
6400	71	71	71	71	71	71	71	71	71	67	65
6600	70	70	70	70	71	71	71	70	70	67	65
6800	70	70	70	70	71	70	70	70	70	67	65
7000	70	70	70	70	70	70	70	70	70	66	65
7200	69	69	70	70	70	70	70	69	69	66	65

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
0	63	62	62	62	64	65	65	71	53	62	62
10	62	62	62	62	63	65	65	71	58	62	62
20	62	62	62	62	63	65	65	71	57	62	62
30	62	62	62	62	63	68	67	71	59	62	62
40	63	62	62	62	63	72	71	71	57	62	62
50	63	62	62	62	63	77	75	71	56	62	62
60	63	62	62	62	63	82	80	71	57	62	62
70	63	62	62	62	63	88	86	71	59	62	62
80	63	62	62	62	63	94	91	71	55	62	62
90	63	62	62	62	63	101	97	71	56	62	62
100	63	62	62	62	63	108	103	71	59	62	62
110	63	62	62	62	63	114	109	71	57	62	62
120	63	62	62	62	63	120	115	71	53	62	62
130	63	62	62	62	63	127	121	71	54	62	62
140	63	62	62	62	63	133	127	71	57	62	62
150	63	62	62	62	63	140	133	71	59	62	62
160	63	62	62	62	63	146	139	71	56	62	62
170	63	62	62	62	63	152	145	72	57	62	62
180	63	62	62	62	63	158	150	72	54	62	62
190	63	62	62	62	63	164	156	72	56	62	62
200	63	62	62	62	63	170	162	72	56	62	62
210	63	62	62	62	63	175	167	72	55	62	62
220	63	62	62	62	63	181	173	72	59	62	62
230	63	62	62	62	63	186	178	72	59	62	62
240	63	62	62	62	63	192	183	72	57	62	62
250	63	62	62	62	63	197	188	72	54	62	62
260	63	62	62	62	63	202	193	72	55	62	62
270	63	62	62	62	64	207	199	72	56	62	62

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
280	63	62	62	63	64	212	203	72	56	62	62
290	63	62	62	63	64	217	208	72	59	62	62
300	63	63	63	63	64	221	212	72	55	62	62
400	65	65	65	65	65	220	215	72	55	62	62
500	67	68	68	68	67	202	200	73	58	63	63
600	68	71	71	71	69	187	186	72	59	62	62
700	69	73	73	73	69	176	175	73	58	62	62
800	71	75	75	74	71	167	165	73	58	62	62
900	71	76	76	75	71	158	158	73	54	62	62
1000	71	76	76	75	70	152	151	73	56	62	62
1200	70	75	76	74	69	140	140	73	60	62	62
1400	69	74	75	73	68	131	131	73	55	62	62
1600	68	73	73	73	68	123	122	73	56	62	62
1800	68	72	73	70	68	116	116	73	55	62	62
2000	68	70	71	69	67	110	110	73	54	63	62
2200	68	70	70	69	67	105	105	73	56	62	62
2400	66	68	69	68	66	100	100	73	53	62	62
2600	66	68	68	67	66	97	97	73	59	62	62
2800	66	67	67	66	66	93	93	73	56	62	62
3000	66	66	66	66	66	89	89	73	57	62	62
3200	66	66	66	66	65	87	87	72	55	62	62
3400	65	66	66	65	65	85	85	73	55	62	62
3600	66	66	66	66	66	82	82	72	57	62	62
3800	66	66	66	66	66	81	81	73	58	63	63
4000	65	66	66	65	66	79	79	72	56	62	62
4200	65	65	65	65	65	78	78	73	56	63	62
4400	64	64	64	64	64	76	76	72	58	62	62
4600	65	64	65	64	65	76	76	72	57	62	62

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
4800	66	65	65	65	66	75	76	73	58	63	63
5000	65	64	64	64	65	74	74	72	56	62	62
5200	64	64	64	64	65	72	73	73	55	62	62
5400	64	64	64	64	65	72	72	74	55	62	62
5600	64	63	63	63	65	71	71	73	59	62	62
5800	64	63	63	63	64	70	70	74	55	62	62
6000	64	64	64	64	64	69	69	74	56	63	63
6200	64	63	63	63	64	69	69	73	55	62	62
6400	64	64	64	64	64	69	69	73	55	63	62
6600	64	63	62	62	64	68	68	73	57	62	62
6800	64	63	62	62	64	68	68	73	58	62	62
7000	64	63	63	63	64	68	68	73	57	63	63
7200	64	63	62	63	64	67	67	73	56	62	62

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
0	0.000	-0.001	-0.001	-0.002	-0.001	-0.001	-0.001	-0.001	0.001	-0.001	-0.001
10	0.000	-0.002	-0.001	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000
20	-0.001	-0.001	-0.001	-0.001	0.000	-0.002	0.000	0.000	0.000	0.000	0.000
30	0.000	-0.001	-0.001	-0.002	0.000	-0.002	0.000	-0.001	-0.001	0.000	-0.001
40	-0.001	-0.001	-0.001	-0.002	0.000	-0.003	-0.001	-0.001	-0.001	-0.001	0.000
50	-0.001	-0.001	-0.001	-0.002	-0.001	-0.002	-0.001	-0.001	-0.001	-0.001	0.000
60	-0.001	-0.001	-0.001	-0.002	-0.001	-0.002	-0.002	-0.002	-0.001	-0.002	-0.001
70	-0.001	-0.001	-0.001	-0.004	-0.001	-0.002	-0.003	-0.002	-0.002	-0.002	-0.001
80	-0.001	-0.002	-0.001	-0.002	-0.002	-0.003	-0.003	-0.005	-0.003	-0.003	-0.001
90	-0.001	-0.002	-0.001	-0.005	-0.002	-0.003	-0.004	-0.005	-0.003	-0.003	-0.002
100	-0.002	-0.002	-0.002	-0.005	-0.002	-0.004	-0.005	-0.006	-0.004	-0.004	-0.002
110	-0.002	-0.003	-0.002	-0.006	-0.003	-0.006	-0.006	-0.008	-0.005	-0.005	-0.002
120	-0.003	-0.003	-0.002	-0.006	-0.003	-0.006	-0.006	-0.009	-0.007	-0.006	-0.003
130	-0.003	-0.004	-0.003	-0.008	-0.004	-0.009	-0.009	-0.011	-0.007	-0.006	-0.003
140	-0.003	-0.005	-0.003	-0.009	-0.004	-0.008	-0.009	-0.012	-0.008	-0.007	-0.003
150	-0.004	-0.006	-0.004	-0.011	-0.005	-0.010	-0.010	-0.014	-0.011	-0.008	-0.004
160	-0.005	-0.007	-0.004	-0.012	-0.005	-0.011	-0.012	-0.016	-0.011	-0.010	-0.004
170	-0.006	-0.008	-0.005	-0.015	-0.006	-0.013	-0.014	-0.019	-0.013	-0.011	-0.005
180	-0.007	-0.009	-0.006	-0.017	-0.007	-0.015	-0.017	-0.021	-0.015	-0.012	-0.005
190	-0.008	-0.011	-0.007	-0.019	-0.007	-0.015	-0.018	-0.024	-0.017	-0.014	-0.006
200	-0.009	-0.013	-0.009	-0.022	-0.009	-0.018	-0.021	-0.027	-0.020	-0.016	-0.007
210	-0.011	-0.015	-0.010	-0.024	-0.009	-0.019	-0.023	-0.030	-0.022	-0.018	-0.008
220	-0.012	-0.017	-0.011	-0.028	-0.010	-0.022	-0.027	-0.034	-0.025	-0.020	-0.008
230	-0.014	-0.019	-0.013	-0.030	-0.012	-0.025	-0.029	-0.038	-0.029	-0.023	-0.009
240	-0.016	-0.022	-0.015	-0.035	-0.013	-0.027	-0.033	-0.043	-0.032	-0.025	-0.010
250	-0.018	-0.025	-0.017	-0.039	-0.014	-0.031	-0.038	-0.048	-0.036	-0.029	-0.011
260	-0.021	-0.029	-0.019	-0.044	-0.016	-0.034	-0.042	-0.054	-0.040	-0.032	-0.013
270	-0.023	-0.032	-0.021	-0.049	-0.018	-0.038	-0.047	-0.060	-0.045	-0.036	-0.014

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
280	-0.026	-0.036	-0.024	-0.055	-0.020	-0.047	-0.058	-0.067	-0.056	-0.044	-0.017
290	-0.029	-0.040	-0.027	-0.060	-0.021	-0.052	-0.064	-0.073	-0.062	-0.049	-0.019
300	-0.031	-0.043	-0.029	-0.064	-0.023	-0.056	-0.068	-0.077	-0.067	-0.052	-0.020
400	-0.021	-0.029	-0.019	-0.042	-0.017	-0.037	-0.046	-0.051	-0.045	-0.035	-0.015
500	-0.014	-0.019	-0.013	-0.030	-0.012	-0.026	-0.031	-0.035	-0.031	-0.024	-0.011
600	-0.010	-0.014	-0.009	-0.021	-0.010	-0.020	-0.023	-0.026	-0.023	-0.019	-0.009
700	-0.008	-0.011	-0.007	-0.017	-0.008	-0.016	-0.018	-0.021	-0.017	-0.015	-0.007
800	-0.007	-0.009	-0.006	-0.014	-0.007	-0.013	-0.015	-0.017	-0.014	-0.012	-0.006
900	-0.006	-0.007	-0.005	-0.012	-0.006	-0.011	-0.013	-0.014	-0.012	-0.010	-0.005
1000	-0.005	-0.007	-0.004	-0.011	-0.005	-0.009	-0.011	-0.012	-0.011	-0.010	-0.005
1200	-0.004	-0.005	-0.003	-0.008	-0.004	-0.009	-0.009	-0.011	-0.009	-0.008	-0.004
1400	-0.003	-0.005	-0.003	-0.007	-0.004	-0.009	-0.008	-0.009	-0.007	-0.007	-0.003
1600	-0.003	-0.004	-0.002	-0.007	-0.003	-0.007	-0.007	-0.008	-0.006	-0.006	-0.003
1800	-0.003	-0.004	-0.002	-0.006	-0.003	-0.007	-0.006	-0.008	-0.006	-0.005	-0.003
2000	-0.002	-0.003	-0.002	-0.005	-0.002	-0.005	-0.004	-0.006	-0.005	-0.005	-0.002
2200	-0.002	-0.003	-0.002	-0.005	-0.002	-0.005	-0.005	-0.006	-0.005	-0.004	-0.002
2400	-0.002	-0.003	-0.002	-0.003	-0.002	-0.005	-0.004	-0.005	-0.004	-0.004	-0.002
2600	-0.002	-0.003	-0.002	-0.004	-0.002	-0.004	-0.003	-0.004	-0.004	-0.003	-0.002
2800	-0.002	-0.003	-0.002	-0.004	-0.002	-0.004	-0.003	-0.004	-0.004	-0.003	-0.002
3000	-0.002	-0.002	-0.002	-0.003	-0.002	-0.004	-0.003	-0.004	-0.003	-0.003	-0.002
3200	-0.002	-0.002	-0.002	-0.002	-0.002	-0.004	-0.003	-0.004	-0.002	-0.003	-0.001
3400	-0.001	-0.002	-0.001	-0.002	-0.001	-0.003	-0.002	-0.003	-0.002	-0.003	-0.001
3600	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003	-0.003	-0.002	-0.002	-0.001
3800	-0.001	-0.002	-0.001	-0.003	-0.001	-0.003	-0.002	-0.003	-0.001	-0.002	-0.001
4000	-0.001	-0.002	-0.002	-0.003	-0.001	-0.002	-0.002	-0.002	-0.003	-0.002	-0.001
4200	-0.001	-0.002	-0.002	-0.003	-0.001	-0.003	-0.002	-0.002	-0.002	-0.002	-0.001
4400	-0.001	-0.002	-0.002	-0.002	-0.001	-0.002	-0.001	-0.002	-0.002	-0.002	-0.001
4600	-0.001	-0.002	-0.002	-0.002	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002	-0.001

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
4800	-0.002	-0.002	-0.002	-0.002	-0.001	-0.002	-0.002	-0.003	-0.002	-0.002	-0.001
5000	-0.001	-0.002	-0.002	-0.002	-0.001	-0.002	-0.002	-0.001	-0.001	-0.002	0.000
5200	-0.001	-0.002	-0.002	-0.002	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002	-0.001
5400	-0.001	-0.002	-0.002	-0.003	-0.001	-0.003	-0.003	-0.002	0.000	-0.002	-0.001
5600	-0.001	-0.002	-0.001	-0.002	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002	0.000
5800	-0.001	-0.002	-0.002	-0.002	-0.001	-0.002	-0.001	-0.002	-0.002	-0.002	-0.001
6000	-0.001	-0.002	-0.002	-0.003	-0.001	-0.002	-0.002	-0.001	-0.001	-0.002	-0.001
6200	-0.001	-0.002	-0.001	-0.001	-0.001	-0.002	-0.001	-0.002	-0.001	-0.002	-0.001
6400	-0.001	-0.002	-0.001	-0.002	-0.001	-0.001	-0.001	-0.003	-0.002	-0.002	-0.001
6600	-0.001	-0.002	-0.002	-0.002	0.000	-0.002	-0.001	-0.002	-0.002	-0.002	0.000
6800	-0.001	-0.002	-0.002	-0.003	-0.001	-0.002	-0.002	-0.002	0.000	-0.001	-0.001
7000	-0.001	-0.002	-0.002	-0.001	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002	-0.001
7200	-0.001	-0.002	-0.001	-0.002	-0.001	-0.003	-0.001	-0.001	-0.002	-0.002	-0.001

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
0	-0.002	-0.001	-0.001	0.000
10	-0.003	-0.001	-0.001	0.000
20	-0.001	-0.001	-0.001	0.000
30	-0.001	-0.001	-0.001	0.000
40	-0.002	-0.001	-0.001	0.000
50	-0.002	-0.001	-0.001	-0.001
60	-0.003	-0.001	-0.001	0.000
70	-0.003	-0.001	-0.001	0.000
80	-0.004	-0.001	-0.001	0.000
90	-0.005	-0.001	-0.002	-0.001
100	-0.006	-0.001	-0.002	-0.001
110	-0.006	-0.002	-0.002	-0.002
120	-0.008	-0.002	-0.003	-0.002
130	-0.009	-0.003	-0.004	-0.002
140	-0.009	-0.004	-0.004	-0.003
150	-0.012	-0.004	-0.006	-0.003
160	-0.013	-0.005	-0.007	-0.004
170	-0.014	-0.006	-0.007	-0.005
180	-0.017	-0.007	-0.009	-0.006
190	-0.019	-0.007	-0.010	-0.006
200	-0.022	-0.009	-0.012	-0.008
210	-0.025	-0.010	-0.014	-0.009
220	-0.027	-0.012	-0.016	-0.010
230	-0.031	-0.013	-0.018	-0.012
240	-0.035	-0.015	-0.021	-0.014
250	-0.039	-0.017	-0.024	-0.016
260	-0.043	-0.019	-0.027	-0.018
270	-0.049	-0.022	-0.031	-0.021

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
280	-0.054	-0.025	-0.034	-0.023
290	-0.060	-0.027	-0.039	-0.026
300	-0.063	-0.029	-0.042	-0.028
400	-0.042	-0.020	-0.027	-0.019
500	-0.029	-0.013	-0.017	-0.013
600	-0.020	-0.009	-0.013	-0.009
700	-0.018	-0.007	-0.010	-0.007
800	-0.015	-0.006	-0.008	-0.006
900	-0.013	-0.005	-0.007	-0.005
1000	-0.011	-0.004	-0.006	-0.004
1200	-0.009	-0.003	-0.004	-0.003
1400	-0.008	-0.003	-0.004	-0.003
1600	-0.008	-0.003	-0.003	-0.002
1800	-0.007	-0.002	-0.003	-0.002
2000	-0.005	-0.002	-0.002	-0.002
2200	-0.005	-0.002	-0.002	-0.002
2400	-0.005	-0.002	-0.002	-0.002
2600	-0.004	-0.002	-0.002	-0.002
2800	-0.004	-0.002	-0.002	-0.002
3000	-0.004	-0.002	-0.002	-0.002
3200	-0.005	-0.002	-0.001	-0.001
3400	-0.004	-0.001	-0.002	-0.001
3600	-0.004	-0.001	-0.002	-0.001
3800	-0.004	-0.001	-0.002	-0.001
4000	-0.004	-0.002	-0.002	-0.001
4200	-0.003	-0.002	-0.002	-0.001
4400	-0.004	-0.001	-0.002	-0.001
4600	-0.003	-0.001	-0.002	-0.001

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0129A)
Time is 07:47:20.12.
Date is 1-29-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
4800	-0.003	-0.001	-0.001	-0.001
5000	-0.003	-0.002	-0.002	-0.001
5200	-0.003	-0.002	-0.002	-0.001
5400	-0.003	-0.001	-0.001	-0.001
5600	-0.003	-0.001	-0.002	-0.001
5800	-0.002	-0.001	-0.002	-0.001
6000	-0.002	-0.002	-0.001	-0.001
6200	-0.003	-0.002	-0.002	-0.001
6400	-0.003	-0.001	-0.002	-0.001
6600	-0.003	-0.001	-0.002	-0.001
6800	-0.003	-0.001	-0.002	-0.001
7000	-0.002	-0.001	-0.002	-0.001
7200	-0.003	-0.001	-0.002	-0.001

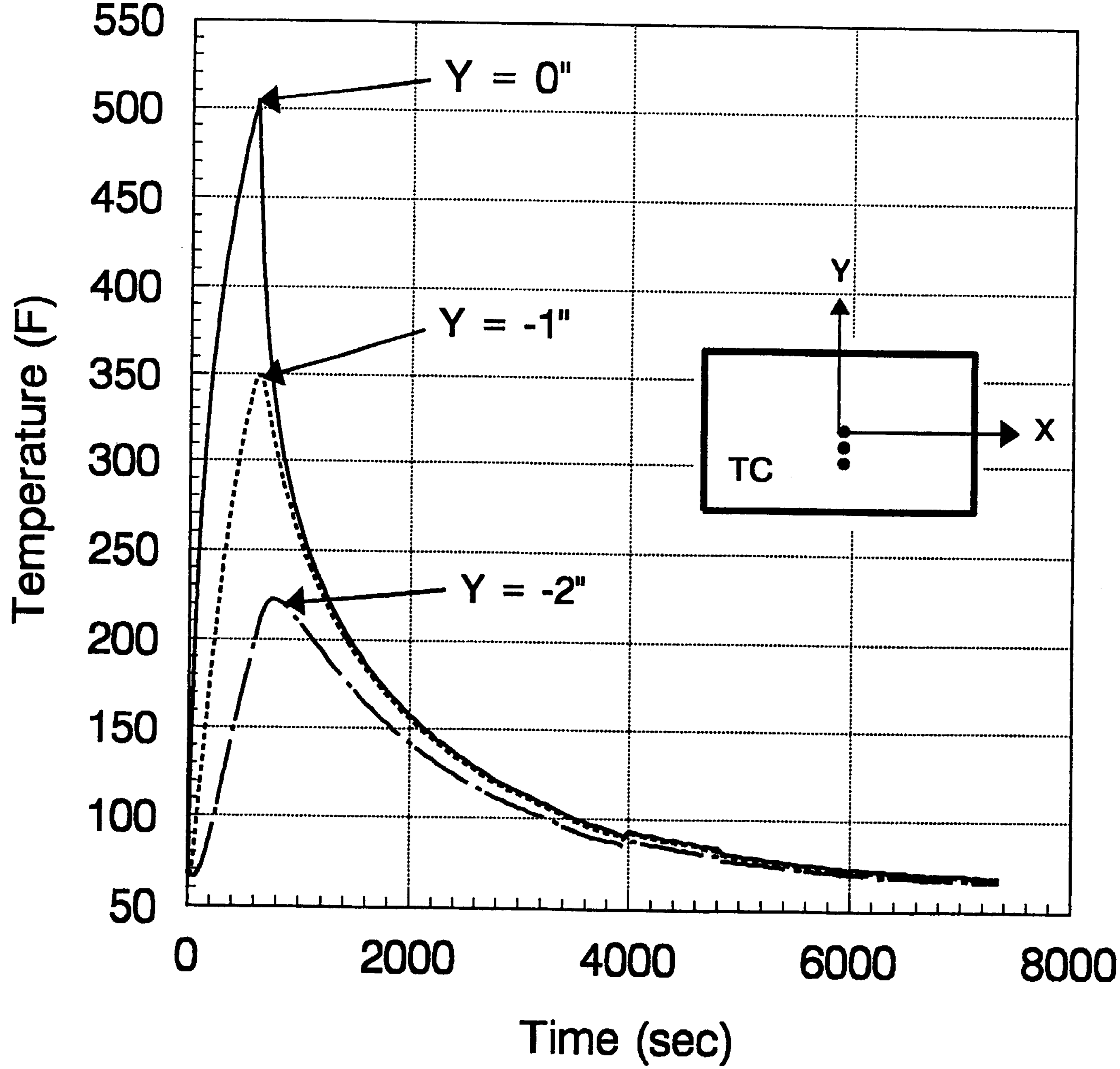
APPENDIX B3

TEST 3 RESULTS

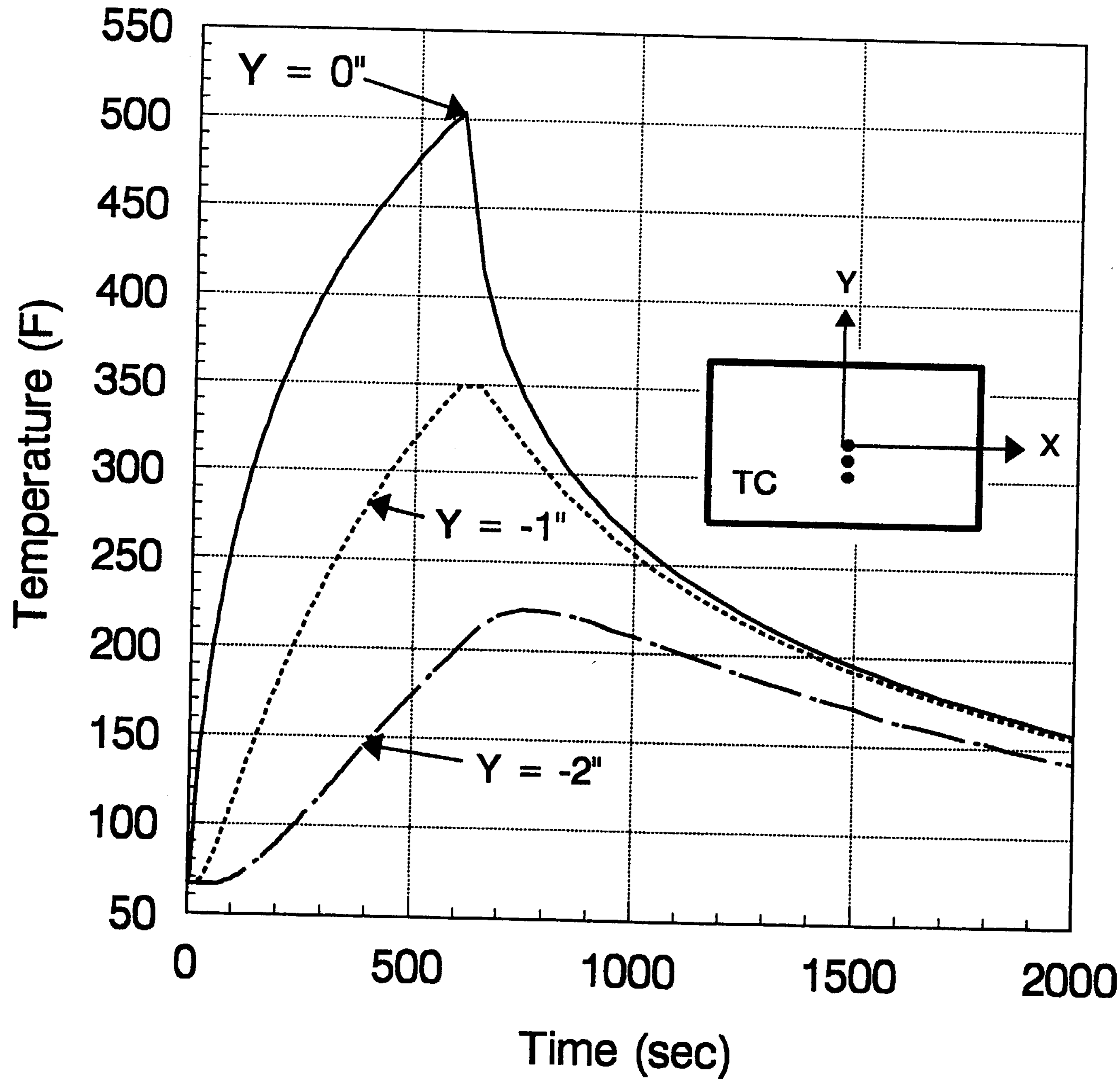
TEST CONDITIONS:

Lamp Power:	15% (.642 Btu/s)
Max Temperature:	500°F
Heat Flux Duration:	600 s
Behavior:	Possibly Plastic

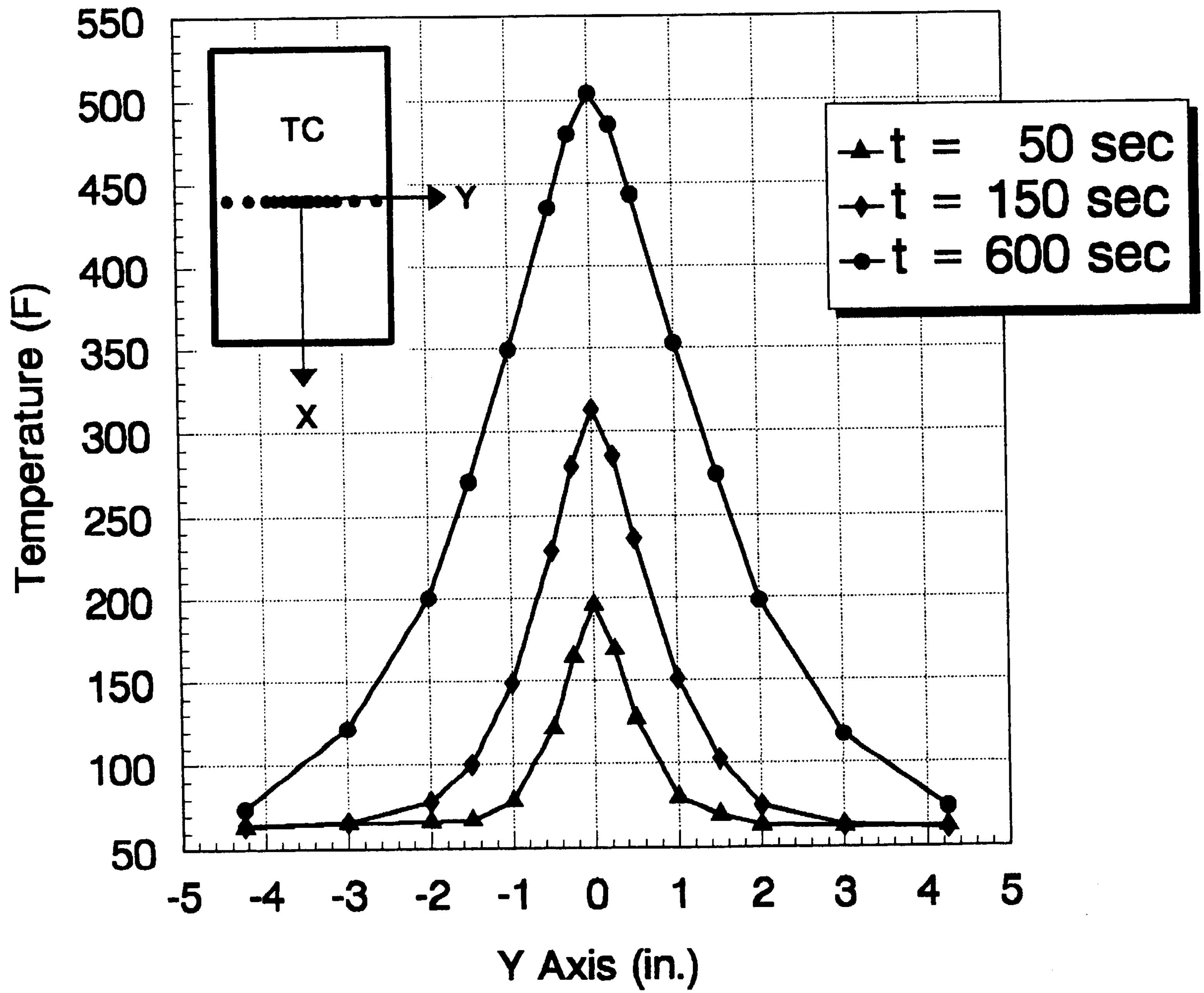
TEST 3 - Panel Temperature History



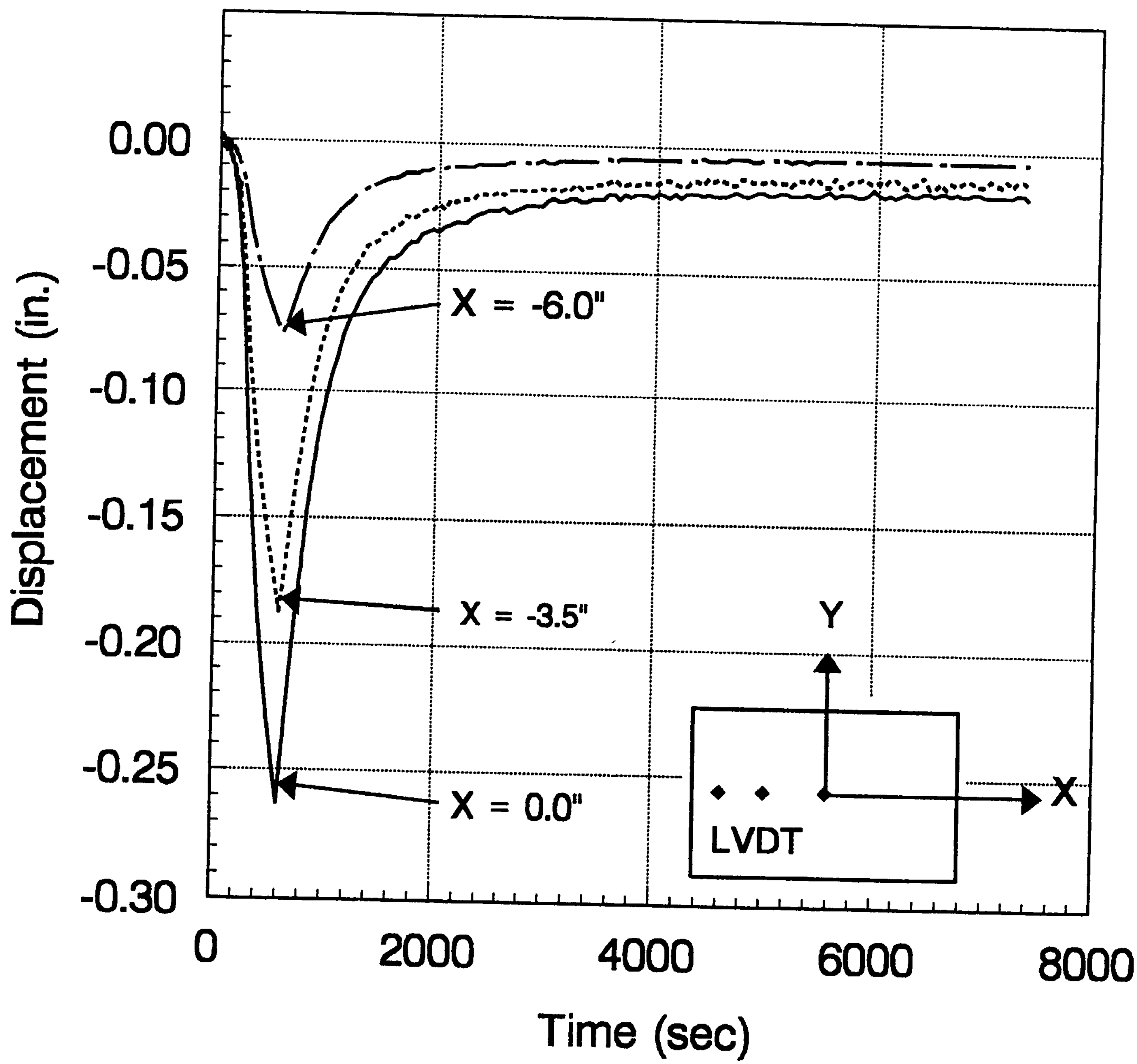
TEST 3 - Panel Temperature History



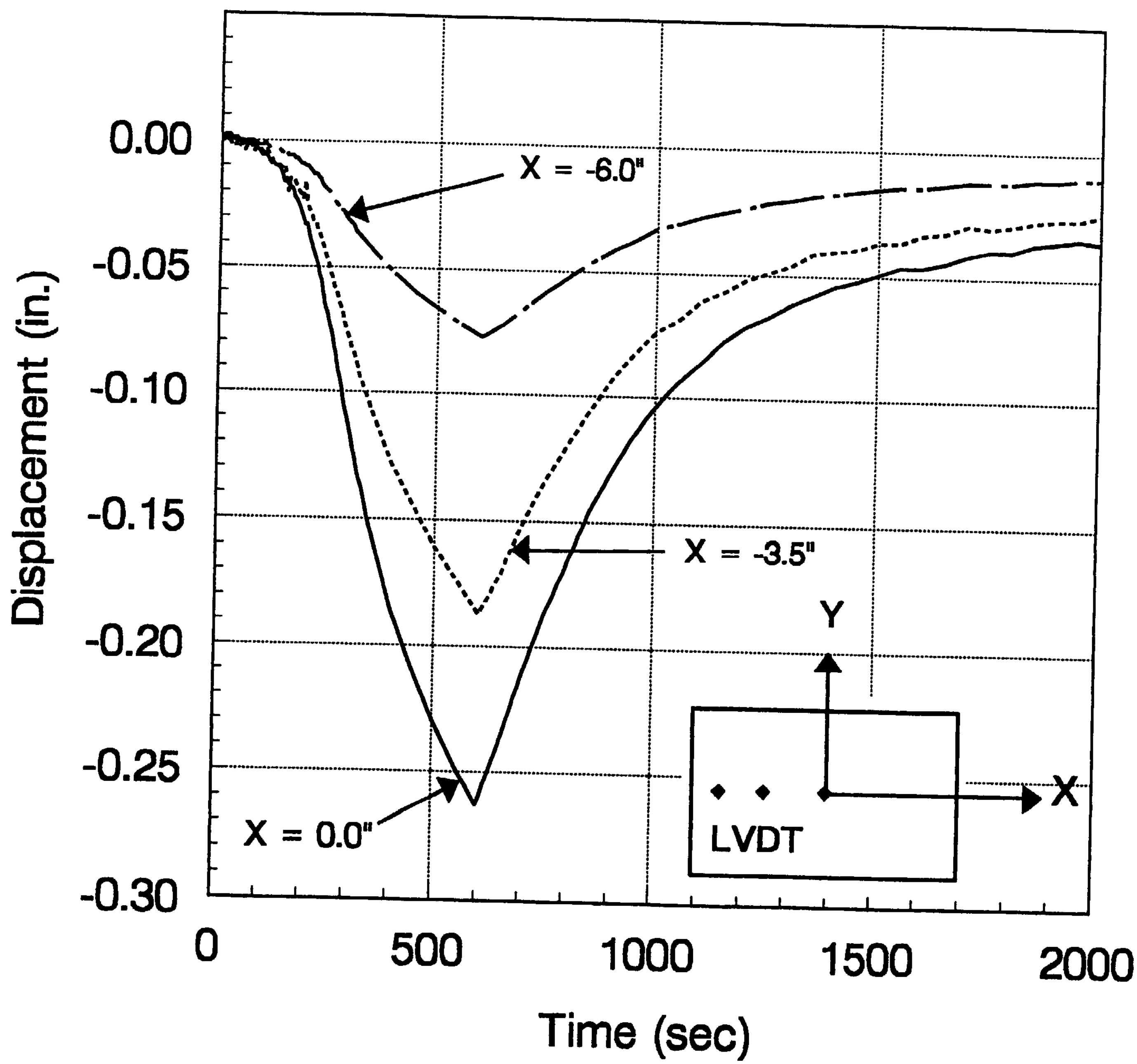
TEST 3 - Panel Temperature Distributions



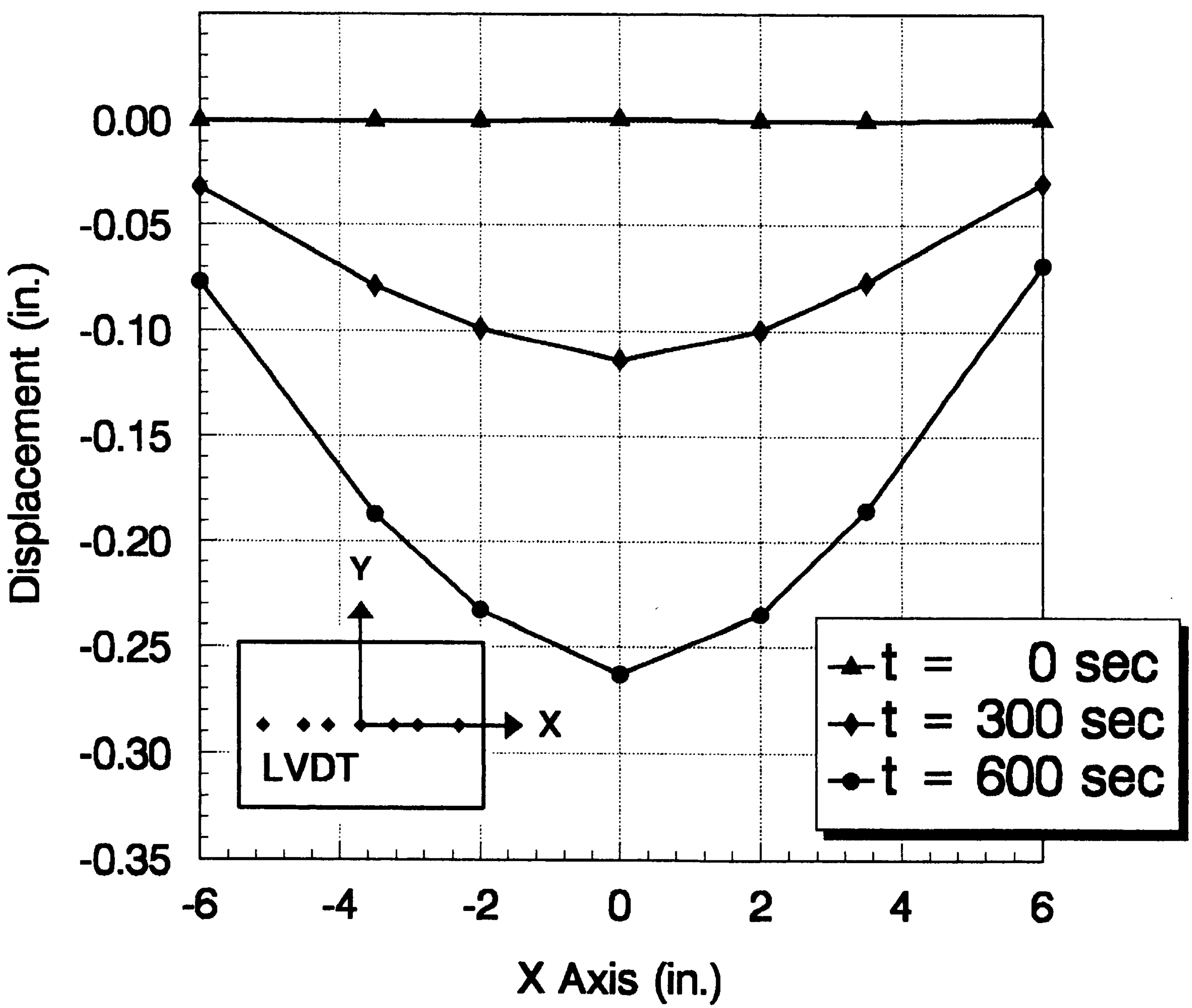
TEST 3 - Panel Displacement History



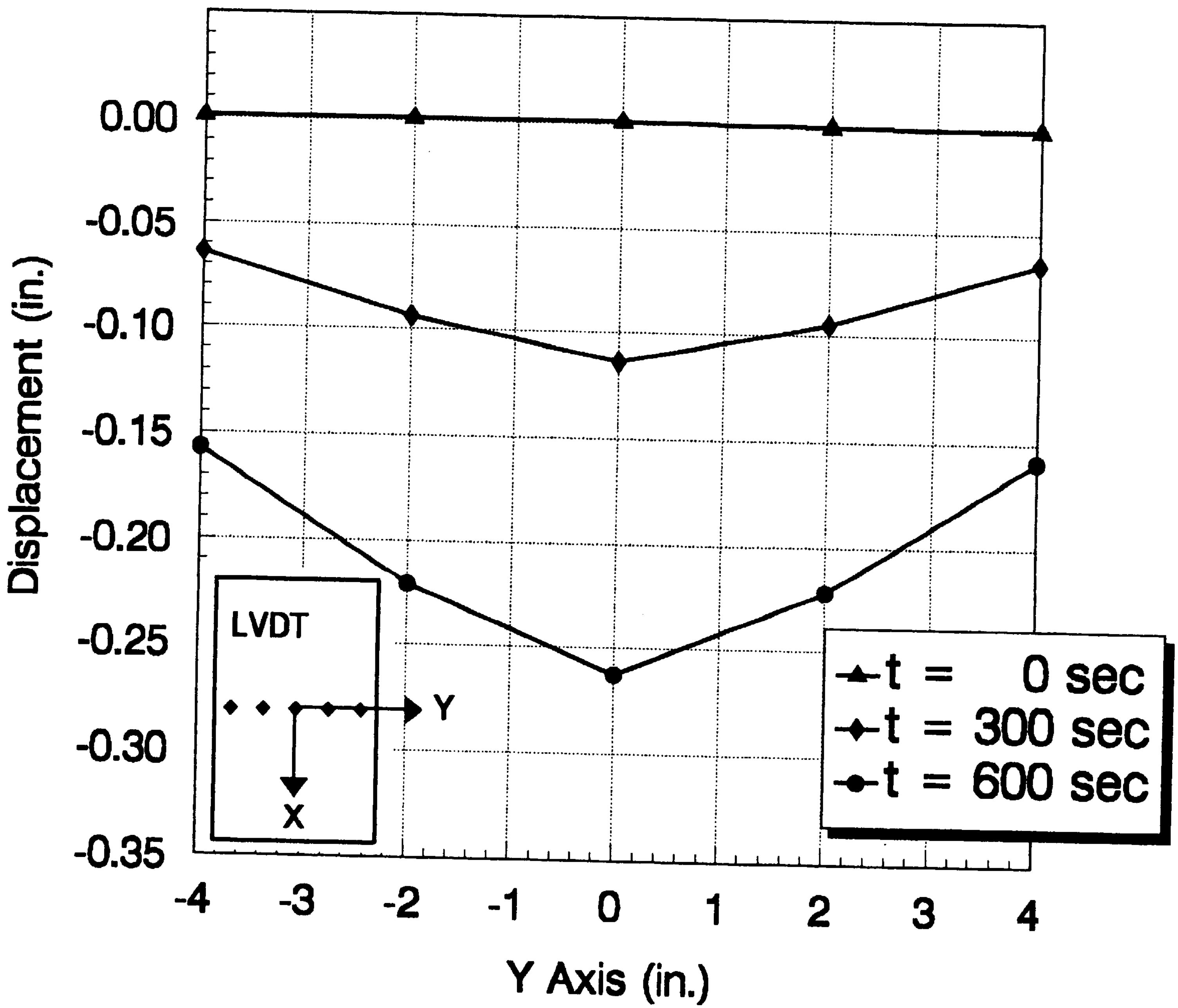
TEST 3 - Panel Displacement History



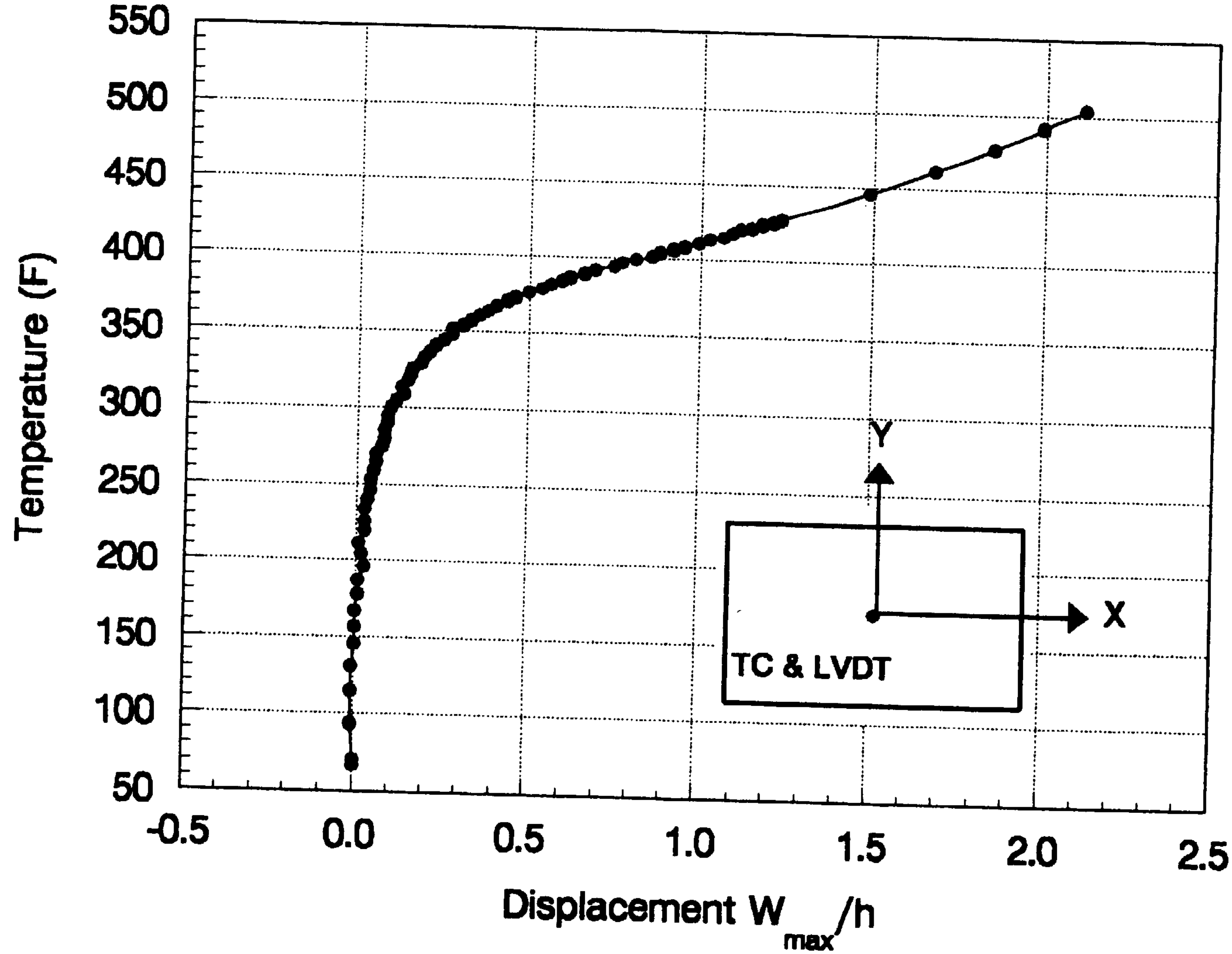
TEST 3 - Panel Displacement Distributions



TEST 3 - Panel Displacement Distributions



TEST 3 - Panel Center Temperature Versus Displacement



SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
0	64	66	66	66	66	66	66	68	67	67	67
10	64	66	66	66	66	69	82	93	93	94	93
20	64	66	66	66	67	79	105	123	130	130	130
30	64	66	66	66	69	93	128	148	156	157	155
40	64	66	66	66	73	108	147	169	177	178	177
50	64	66	66	67	78	121	165	186	195	196	195
60	64	66	66	69	84	135	180	202	210	211	210
70	64	66	66	71	91	146	193	215	224	225	225
80	64	66	67	74	98	158	206	228	238	239	238
90	64	66	68	77	105	170	219	240	250	251	251
100	64	66	69	80	112	181	230	252	262	263	262
110	64	66	71	84	119	191	241	262	272	273	273
120	64	66	72	87	127	201	252	272	281	284	284
130	64	66	74	91	134	210	261	280	291	293	292
140	64	66	75	96	141	218	270	288	298	302	301
150	64	66	78	100	149	228	280	297	308	310	310
160	64	67	80	104	154	236	288	304	314	318	318
170	64	67	82	108	161	244	296	311	322	326	326
180	64	67	85	113	168	252	303	318	330	333	332
190	64	68	86	118	174	260	311	324	337	340	340
200	64	69	89	122	181	266	318	331	343	347	347
210	64	69	92	127	187	273	324	336	349	353	353
220	64	69	94	131	193	280	331	342	355	359	359
230	64	70	98	135	199	286	338	347	361	366	365
240	65	71	100	140	205	292	344	352	366	372	371
250	65	72	103	145	210	299	349	358	372	377	376
260	65	73	106	149	217	305	355	362	377	383	381
270	65	74	109	154	222	310	360	367	382	388	387

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
280	65	75	112	158	227	316	365	372	387	393	391
290	65	76	114	162	232	321	371	376	391	397	396
300	65	76	117	166	238	326	376	379	396	402	400
310	65	78	120	170	243	331	381	384	401	407	405
320	66	79	123	174	247	336	385	388	405	412	409
330	66	80	126	179	252	340	390	391	409	416	414
340	66	82	130	183	256	345	394	396	413	421	417
350	66	82	132	187	261	350	398	399	417	425	421
400	67	89	147	206	282	371	418	416	435	445	440
450	68	97	161	224	302	389	436	429	451	462	455
500	70	105	175	240	319	405	451	442	464	476	469
550	72	113	188	256	335	421	466	454	477	491	484
600	74	121	200	271	349	435	480	463	489	504	496
650	76	130	213	281	349	399	411	364	390	411	408
700	77	138	220	280	333	364	371	317	344	367	365
750	80	144	223	275	316	338	342	286	314	337	338
800	82	150	222	267	301	318	320	262	292	315	316
850	84	154	220	259	287	302	302	245	274	297	300
900	85	156	217	252	276	287	288	230	258	282	285
950	87	157	213	244	265	274	275	218	245	269	273
1000	88	157	210	237	256	263	264	207	234	257	262
1100	88	155	201	224	239	245	246	190	215	238	243
1200	88	152	193	212	225	230	230	177	200	222	228
1300	87	148	185	202	212	217	217	165	187	209	215
1400	87	144	178	193	202	205	205	156	176	197	203
1500	86	140	171	184	192	195	195	148	167	187	194
1600	84	136	164	176	184	186	186	141	159	178	184
1700	83	131	158	169	175	178	178	136	151	170	176

TEST 3; PAGE 3 OF 15

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
1800	82	127	153	163	168	171	171	130	145	163	169
2000	80	120	142	150	156	158	158	121	134	149	156
2200	78	113	133	140	145	146	146	114	126	139	145
2400	76	107	125	130	135	136	136	108	118	130	136
2600	75	102	118	124	127	129	129	103	111	122	128
2800	74	97	111	116	119	121	121	98	106	115	120
3000	73	94	106	110	113	114	115	95	102	109	114
3200	72	90	101	105	107	109	109	92	97	105	108
3400	69	86	95	99	101	102	102	88	92	99	102
3600	67	83	91	94	96	98	98	85	89	94	97
3800	67	80	87	91	93	93	93	82	87	91	93
4000	69	81	87	90	93	93	93	84	86	91	93
4200	68	79	85	88	89	90	90	83	85	89	90
4400	68	78	84	85	87	88	88	81	84	86	88
4600	67	77	82	84	85	85	86	80	82	84	86
4800	67	75	80	82	83	84	84	79	81	83	84
5000	65	72	76	78	78	79	79	76	77	78	80
5200	64	71	75	76	78	78	78	75	76	77	78
5400	64	70	73	75	76	76	76	74	74	76	76
5600	63	68	72	73	74	74	74	73	73	74	75
5800	62	68	71	72	73	73	74	72	73	73	74
6000	62	66	70	71	71	71	72	71	71	72	72
6200	62	67	69	70	71	71	71	71	71	72	72
6400	62	66	69	69	70	70	70	70	70	71	71
6600	62	65	68	69	69	70	70	70	70	70	70
6800	61	65	67	68	69	69	69	70	69	70	70
7000	62	66	67	68	69	69	69	70	70	70	70
7200	62	64	67	67	67	68	68	69	69	68	69

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
0	67	67	67	67	68	67	67	68	68	63	63
10	93	93	92	90	94	82	70	67	68	63	63
20	130	128	126	123	128	109	83	68	68	63	62
30	156	154	152	147	153	133	98	71	68	63	62
40	178	174	173	167	173	152	114	75	68	64	63
50	196	193	190	184	188	169	127	80	70	64	63
60	212	208	206	199	204	184	141	87	71	63	63
70	226	222	221	213	218	199	154	93	73	64	63
80	240	236	234	226	230	213	166	100	76	64	63
90	253	248	247	239	242	225	177	107	79	65	63
100	265	259	258	249	253	236	188	115	82	67	62
110	275	271	269	260	263	247	199	123	86	67	62
120	285	280	279	269	273	258	209	129	90	69	63
130	295	291	290	280	282	268	218	137	94	72	63
140	304	299	298	288	290	277	227	143	98	73	63
150	313	308	307	296	298	286	236	151	103	75	63
160	321	316	315	304	306	294	244	157	107	77	63
170	328	324	323	312	313	301	253	164	112	79	64
180	336	332	331	319	319	309	260	171	116	81	64
190	344	339	339	326	327	316	267	177	121	85	65
200	351	345	345	333	333	324	275	184	125	86	65
210	357	352	352	339	339	331	281	190	130	89	66
220	363	358	358	345	344	337	288	196	134	91	67
230	370	365	364	351	349	343	295	202	139	95	67
240	376	372	371	357	355	350	301	208	144	97	68
250	381	377	377	362	360	356	307	213	148	100	69
260	386	383	382	367	365	361	313	219	153	104	70
270	391	388	387	372	371	366	318	224	157	106	71

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
280	397	393	392	377	375	372	323	229	161	109	72
290	401	398	397	383	379	377	329	235	166	112	74
300	406	402	402	387	384	382	334	240	170	115	75
310	410	408	407	391	388	386	339	245	174	118	75
320	415	412	412	397	392	391	344	249	179	121	76
330	420	416	416	401	397	397	348	255	183	123	78
340	423	421	421	405	401	400	353	260	187	127	78
350	427	425	425	409	404	404	358	264	191	129	80
400	446	445	445	429	422	424	379	285	210	145	87
450	462	462	462	446	438	442	397	305	228	159	93
500	477	477	478	461	451	458	413	322	245	173	102
550	492	491	492	475	463	472	429	337	261	185	110
600	504	504	506	487	474	485	443	353	275	198	117
650	415	414	415	397	377	412	401	351	287	210	126
700	371	371	371	353	331	371	364	334	285	218	133
750	343	342	343	325	301	343	339	317	278	219	140
800	320	320	319	301	278	321	319	301	271	218	145
850	302	302	302	283	259	303	302	288	263	215	148
900	288	287	285	267	244	289	287	276	254	213	150
950	275	274	273	253	230	276	275	266	246	208	151
1000	264	263	261	241	219	265	264	256	239	205	152
1100	245	244	240	222	201	246	246	240	225	197	150
1200	230	228	225	207	187	231	230	225	214	189	148
1300	217	215	211	193	175	217	217	213	203	181	143
1400	205	203	199	182	165	206	206	203	194	173	139
1500	195	194	189	173	156	196	196	193	185	167	135
1600	186	184	179	164	149	187	187	184	178	160	132
1700	178	176	171	156	142	179	179	176	170	154	127

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
1800	171	169	165	149	137	172	172	169	165	148	123
2000	158	156	151	138	127	159	159	156	152	138	116
2200	147	145	140	128	119	147	147	146	141	129	109
2400	137	136	130	120	111	137	137	136	132	122	104
2600	129	127	123	113	106	129	129	128	124	115	99
2800	121	119	116	107	101	122	122	120	118	108	94
3000	115	113	110	102	97	115	115	114	112	103	91
3200	109	108	105	98	94	110	110	108	106	99	88
3400	103	102	99	93	89	103	103	102	100	94	83
3600	98	97	94	89	86	99	99	97	95	89	81
3800	94	93	91	87	83	94	94	93	92	86	78
4000	93	93	91	87	85	94	93	93	92	86	79
4200	91	90	89	85	84	91	91	90	89	83	77
4400	89	88	86	84	82	89	89	88	87	81	75
4600	86	85	84	82	80	86	86	86	84	79	74
4800	84	84	83	81	79	84	84	84	83	78	73
5000	80	79	78	77	76	80	80	79	78	75	70
5200	78	78	77	76	75	78	78	78	78	73	69
5400	76	76	76	75	74	76	76	76	76	72	68
5600	75	75	74	73	73	75	75	75	74	70	67
5800	74	74	73	73	72	74	74	74	73	69	66
6000	72	72	71	71	71	72	72	72	71	68	66
6200	72	72	71	71	71	72	72	72	71	68	65
6400	71	71	71	70	70	71	71	71	70	67	64
6600	70	70	70	70	70	70	70	70	70	67	64
6800	70	70	69	69	69	70	70	70	69	66	64
7000	70	70	70	70	70	70	70	70	69	66	64
7200	68	68	68	68	69	69	69	68	68	65	63

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
0	62	62	62	62	63	64	64	72	56	62	62
10	62	62	62	62	63	64	64	71	58	62	62
20	62	62	62	62	63	64	65	72	58	62	62
30	62	62	62	62	63	67	68	72	58	62	62
40	64	63	62	63	64	73	73	72	57	63	63
50	63	63	63	63	64	78	78	72	53	63	63
60	63	63	62	63	64	84	84	72	57	63	63
70	62	62	62	62	63	91	90	72	55	62	62
80	63	62	62	62	63	98	98	72	55	62	62
90	63	62	62	62	63	105	105	72	58	62	62
100	63	62	62	62	63	113	112	72	56	62	62
110	62	62	62	62	63	120	120	72	57	62	62
120	63	62	62	62	63	127	127	71	55	62	62
130	62	62	62	62	63	135	134	72	56	62	62
140	62	62	62	62	63	142	141	72	55	62	62
150	62	62	62	62	63	149	148	72	58	62	62
160	62	62	62	62	63	156	155	72	55	62	62
170	62	62	62	62	63	162	162	72	55	62	62
180	63	63	63	63	64	170	169	72	54	63	63
190	63	63	63	63	64	177	176	72	53	63	63
200	63	63	62	63	64	182	181	72	53	63	63
210	62	62	62	62	63	189	188	72	58	62	62
220	62	62	62	62	63	195	194	72	58	62	62
230	63	63	63	63	64	200	200	72	57	63	63
240	63	63	63	63	64	206	206	72	58	63	63
250	64	63	63	63	64	212	211	72	56	63	63
260	64	63	63	63	64	218	217	72	56	63	63
270	64	63	63	63	64	223	222	72	53	63	63

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
280	64	63	63	63	64	229	228	72	57	63	63
290	64	63	63	63	64	234	233	73	55	63	63
300	64	63	63	63	64	239	238	73	58	63	63
310	64	64	64	64	64	244	243	73	57	63	63
320	64	64	64	64	64	249	248	73	53	63	63
330	64	64	64	64	64	254	252	73	55	63	63
340	63	63	63	63	64	258	257	73	55	62	62
350	64	64	64	64	64	262	262	73	52	63	63
400	65	66	66	66	66	285	283	72	56	63	63
450	66	66	67	66	66	303	302	71	54	63	63
500	67	68	69	69	68	321	319	71	58	63	63
550	68	70	72	72	69	336	335	71	52	63	63
600	70	73	74	73	71	350	349	72	54	63	63
650	72	75	76	76	73	350	349	72	53	63	63
700	74	78	79	79	74	332	331	73	57	63	63
750	74	80	81	80	75	314	314	72	54	63	62
800	76	82	83	83	77	299	298	72	52	63	62
850	77	84	86	85	78	286	285	72	58	63	63
900	78	86	87	86	79	274	273	72	55	64	63
950	78	86	88	87	78	263	262	71	54	62	62
1000	79	87	89	88	79	254	253	72	55	63	63
1100	80	88	90	88	79	237	237	72	56	63	63
1200	79	88	90	88	78	223	222	73	57	63	63
1300	78	87	89	87	77	210	210	73	55	62	62
1400	78	86	88	85	76	199	199	73	51	62	62
1500	76	85	86	84	75	190	190	73	52	63	63
1600	76	84	85	84	75	181	181	74	57	64	64
1700	75	83	84	82	74	174	174	73	58	63	63

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
1800	74	81	83	80	73	166	166	73	57	63	62
2000	73	80	80	79	71	153	153	74	54	63	63
2200	71	77	79	76	70	143	143	74	51	63	63
2400	70	76	77	75	69	133	133	73	56	63	63
2600	69	74	75	73	69	125	125	73	58	63	63
2800	68	71	73	71	68	117	117	73	60	62	62
3000	67	71	72	70	67	111	111	73	58	62	62
3200	67	70	70	69	67	106	106	73	57	62	62
3400	66	67	68	67	66	100	100	73	57	62	62
3600	65	66	66	66	65	95	95	72	56	60	60
3800	64	66	66	65	64	91	91	72	59	60	60
4000	66	67	67	67	66	91	91	73	53	63	63
4200	66	67	67	66	66	88	88	73	53	62	62
4400	66	66	66	66	66	85	86	72	53	63	63
4600	65	66	66	65	66	83	83	73	55	62	62
4800	65	65	65	65	65	80	80	72	53	63	63
5000	64	64	64	63	64	78	78	72	56	61	61
5200	63	63	63	63	64	77	77	72	60	61	60
5400	63	62	63	62	63	75	75	73	58	61	61
5600	62	62	62	62	63	73	73	72	56	61	61
5800	62	61	61	61	62	71	72	72	58	60	60
6000	62	62	62	62	62	70	70	73	57	60	60
6200	62	62	62	62	62	69	69	73	56	60	60
6400	62	61	61	61	62	68	68	73	60	60	60
6600	62	61	61	61	62	68	68	73	54	60	60
6800	62	61	61	61	62	68	68	73	60	60	60
7000	62	61	61	61	62	67	67	73	58	60	60
7200	62	61	61	61	61	66	66	72	53	60	60

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
0	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.001
10	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.002	0.000	0.001	0.001
20	0.002	0.001	0.002	0.001	0.001	-0.001	0.002	0.002	0.002	0.000	0.001
30	0.001	0.001	0.002	0.002	0.000	-0.003	0.002	0.001	0.001	0.000	0.000
40	0.001	0.002	0.002	0.001	0.000	-0.003	-0.001	0.000	0.001	0.000	0.000
50	0.001	0.001	0.002	0.000	0.000	-0.002	0.001	-0.002	-0.001	-0.001	-0.001
60	0.001	0.001	0.002	0.001	-0.001	-0.002	-0.001	0.000	-0.001	-0.001	-0.001
70	0.000	0.001	0.002	-0.001	0.000	-0.002	-0.001	-0.002	-0.002	-0.002	-0.001
80	0.000	0.001	0.002	-0.001	-0.001	-0.003	-0.002	-0.003	-0.002	-0.002	-0.001
90	0.000	0.000	0.001	-0.001	-0.002	-0.005	-0.003	-0.004	-0.005	-0.004	-0.002
100	0.000	-0.001	0.001	-0.004	-0.001	-0.004	-0.006	-0.006	-0.005	-0.004	-0.002
110	-0.001	-0.001	0.000	-0.003	-0.003	-0.006	-0.007	-0.008	-0.006	-0.005	-0.002
120	-0.001	-0.002	-0.001	-0.006	-0.003	-0.009	-0.009	-0.009	-0.008	-0.007	-0.003
130	-0.002	-0.003	-0.001	-0.009	-0.003	-0.010	-0.010	-0.010	-0.010	-0.008	-0.003
140	-0.003	-0.004	-0.002	-0.009	-0.005	-0.011	-0.012	-0.013	-0.011	-0.009	-0.004
150	-0.004	-0.006	-0.003	-0.012	-0.005	-0.013	-0.014	-0.015	-0.012	-0.011	-0.004
160	-0.005	-0.008	-0.004	-0.013	-0.006	-0.015	-0.015	-0.018	-0.014	-0.013	-0.006
170	-0.007	-0.009	-0.005	-0.018	-0.007	-0.016	-0.019	-0.022	-0.020	-0.015	-0.006
180	-0.008	-0.012	-0.007	-0.020	-0.008	-0.020	-0.023	-0.025	-0.022	-0.018	-0.008
190	-0.010	-0.014	-0.008	-0.024	-0.009	-0.023	-0.026	-0.030	-0.025	-0.021	-0.009
200	-0.012	-0.017	-0.010	-0.028	-0.010	-0.025	-0.029	-0.033	-0.031	-0.024	-0.010
210	-0.014	-0.020	-0.012	-0.032	-0.012	-0.029	-0.034	-0.040	-0.034	-0.028	-0.011
220	-0.017	-0.024	-0.014	-0.039	-0.013	-0.032	-0.041	-0.046	-0.040	-0.032	-0.012
230	-0.020	-0.028	-0.017	-0.043	-0.015	-0.037	-0.046	-0.053	-0.045	-0.037	-0.014
240	-0.023	-0.032	-0.021	-0.049	-0.018	-0.042	-0.053	-0.061	-0.053	-0.041	-0.016
250	-0.026	-0.037	-0.024	-0.056	-0.020	-0.048	-0.058	-0.069	-0.060	-0.047	-0.018
260	-0.029	-0.042	-0.027	-0.064	-0.022	-0.054	-0.066	-0.076	-0.067	-0.053	-0.020
270	-0.033	-0.047	-0.031	-0.071	-0.025	-0.059	-0.075	-0.085	-0.074	-0.059	-0.023

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
280	-0.037	-0.053	-0.035	-0.080	-0.027	-0.066	-0.082	-0.095	-0.083	-0.065	-0.025
290	-0.041	-0.059	-0.039	-0.088	-0.030	-0.073	-0.092	-0.106	-0.092	-0.072	-0.027
300	-0.045	-0.064	-0.043	-0.094	-0.032	-0.079	-0.099	-0.114	-0.100	-0.077	-0.030
310	-0.049	-0.069	-0.046	-0.102	-0.035	-0.084	-0.107	-0.123	-0.107	-0.083	-0.031
320	-0.052	-0.075	-0.050	-0.109	-0.037	-0.090	-0.114	-0.132	-0.114	-0.089	-0.034
330	-0.056	-0.080	-0.053	-0.114	-0.039	-0.096	-0.120	-0.138	-0.122	-0.094	-0.035
340	-0.059	-0.084	-0.055	-0.122	-0.041	-0.101	-0.127	-0.146	-0.128	-0.099	-0.037
350	-0.062	-0.088	-0.058	-0.128	-0.043	-0.106	-0.133	-0.153	-0.134	-0.104	-0.038
400	-0.075	-0.107	-0.071	-0.154	-0.052	-0.128	-0.161	-0.185	-0.162	-0.125	-0.046
450	-0.086	-0.123	-0.082	-0.175	-0.060	-0.145	-0.183	-0.209	-0.185	-0.144	-0.053
500	-0.095	-0.135	-0.091	-0.193	-0.066	-0.161	-0.202	-0.230	-0.204	-0.159	-0.059
550	-0.103	-0.147	-0.099	-0.209	-0.072	-0.174	-0.219	-0.248	-0.219	-0.173	-0.064
600	-0.110	-0.157	-0.106	-0.221	-0.077	-0.187	-0.233	-0.263	-0.235	-0.185	-0.069
650	-0.103	-0.144	-0.097	-0.202	-0.072	-0.171	-0.210	-0.239	-0.213	-0.167	-0.065
700	-0.091	-0.128	-0.086	-0.181	-0.065	-0.151	-0.188	-0.212	-0.188	-0.148	-0.059
750	-0.081	-0.113	-0.076	-0.161	-0.058	-0.134	-0.166	-0.187	-0.167	-0.132	-0.053
800	-0.071	-0.100	-0.067	-0.141	-0.052	-0.120	-0.146	-0.167	-0.147	-0.116	-0.047
850	-0.063	-0.088	-0.059	-0.125	-0.046	-0.106	-0.129	-0.146	-0.130	-0.102	-0.042
900	-0.055	-0.078	-0.052	-0.111	-0.041	-0.093	-0.114	-0.130	-0.115	-0.091	-0.037
950	-0.049	-0.069	-0.046	-0.099	-0.037	-0.083	-0.102	-0.116	-0.103	-0.081	-0.034
1000	-0.043	-0.062	-0.041	-0.089	-0.032	-0.074	-0.092	-0.104	-0.092	-0.073	-0.030
1100	-0.035	-0.050	-0.033	-0.071	-0.027	-0.061	-0.075	-0.086	-0.077	-0.060	-0.025
1200	-0.029	-0.041	-0.027	-0.060	-0.023	-0.052	-0.064	-0.071	-0.064	-0.050	-0.021
1300	-0.025	-0.035	-0.023	-0.052	-0.020	-0.046	-0.054	-0.062	-0.056	-0.044	-0.019
1400	-0.022	-0.031	-0.020	-0.045	-0.017	-0.040	-0.048	-0.054	-0.050	-0.038	-0.016
1500	-0.019	-0.028	-0.018	-0.040	-0.015	-0.036	-0.043	-0.049	-0.044	-0.035	-0.015
1600	-0.018	-0.025	-0.016	-0.036	-0.014	-0.033	-0.039	-0.046	-0.039	-0.032	-0.013
1700	-0.016	-0.023	-0.015	-0.034	-0.012	-0.029	-0.037	-0.041	-0.036	-0.029	-0.012

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
1800	-0.014	-0.021	-0.013	-0.031	-0.012	-0.029	-0.033	-0.039	-0.034	-0.027	-0.011
2000	-0.013	-0.018	-0.012	-0.028	-0.010	-0.024	-0.028	-0.035	-0.030	-0.024	-0.010
2200	-0.011	-0.016	-0.010	-0.024	-0.009	-0.022	-0.027	-0.031	-0.026	-0.021	-0.009
2400	-0.010	-0.015	-0.009	-0.022	-0.008	-0.020	-0.024	-0.027	-0.025	-0.019	-0.008
2600	-0.010	-0.014	-0.008	-0.019	-0.008	-0.020	-0.023	-0.025	-0.022	-0.018	-0.007
2800	-0.009	-0.013	-0.008	-0.019	-0.007	-0.018	-0.020	-0.024	-0.021	-0.017	-0.006
3000	-0.008	-0.012	-0.008	-0.018	-0.007	-0.018	-0.019	-0.022	-0.019	-0.015	-0.005
3200	-0.008	-0.012	-0.007	-0.017	-0.006	-0.017	-0.017	-0.021	-0.018	-0.015	-0.006
3400	-0.007	-0.011	-0.007	-0.016	-0.006	-0.016	-0.017	-0.021	-0.018	-0.014	-0.005
3600	-0.007	-0.011	-0.007	-0.016	-0.006	-0.013	-0.017	-0.019	-0.018	-0.014	-0.005
3800	-0.007	-0.011	-0.007	-0.015	-0.005	-0.015	-0.016	-0.019	-0.016	-0.014	-0.005
4000	-0.007	-0.011	-0.007	-0.016	-0.005	-0.014	-0.016	-0.018	-0.017	-0.013	-0.005
4200	-0.007	-0.011	-0.007	-0.015	-0.005	-0.015	-0.017	-0.020	-0.016	-0.013	-0.004
4400	-0.007	-0.011	-0.007	-0.015	-0.004	-0.014	-0.015	-0.019	-0.015	-0.013	-0.004
4600	-0.007	-0.011	-0.007	-0.014	-0.005	-0.013	-0.016	-0.019	-0.016	-0.012	-0.004
4800	-0.007	-0.011	-0.007	-0.013	-0.004	-0.012	-0.015	-0.019	-0.017	-0.013	-0.004
5000	-0.007	-0.011	-0.007	-0.013	-0.004	-0.012	-0.015	-0.018	-0.016	-0.012	-0.004
5200	-0.007	-0.011	-0.007	-0.013	-0.005	-0.014	-0.014	-0.018	-0.016	-0.013	-0.004
5400	-0.007	-0.010	-0.007	-0.012	-0.004	-0.011	-0.014	-0.018	-0.016	-0.012	-0.004
5600	-0.007	-0.011	-0.007	-0.013	-0.004	-0.011	-0.016	-0.018	-0.014	-0.012	-0.004
5800	-0.007	-0.011	-0.007	-0.013	-0.004	-0.012	-0.015	-0.018	-0.016	-0.012	-0.003
6000	-0.006	-0.011	-0.007	-0.014	-0.004	-0.012	-0.015	-0.017	-0.015	-0.012	-0.004
6200	-0.007	-0.010	-0.007	-0.013	-0.004	-0.013	-0.013	-0.017	-0.015	-0.012	-0.004
6400	-0.007	-0.011	-0.007	-0.015	-0.004	-0.010	-0.015	-0.016	-0.015	-0.012	-0.004
6600	-0.007	-0.010	-0.007	-0.012	-0.004	-0.014	-0.014	-0.016	-0.014	-0.012	-0.003
6800	-0.007	-0.010	-0.007	-0.012	-0.004	-0.011	-0.012	-0.017	-0.015	-0.011	-0.003
7000	-0.007	-0.011	-0.007	-0.012	-0.004	-0.011	-0.013	-0.017	-0.015	-0.012	-0.003
7200	-0.007	-0.011	-0.007	-0.013	-0.004	-0.013	-0.013	-0.017	-0.015	-0.012	-0.003

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
0	0.000	-0.001	-0.001	-0.001
10	-0.001	-0.001	-0.001	-0.001
20	-0.001	0.000	-0.001	-0.002
30	-0.001	0.000	-0.001	-0.001
40	-0.001	-0.001	-0.001	-0.002
50	-0.002	-0.001	-0.001	-0.002
60	-0.002	-0.001	-0.001	-0.001
70	-0.002	-0.001	-0.001	-0.001
80	-0.003	-0.001	-0.002	-0.002
90	-0.006	-0.002	-0.002	-0.002
100	-0.005	-0.002	-0.003	-0.002
110	-0.005	-0.002	-0.004	-0.003
120	-0.008	-0.003	-0.004	-0.003
130	-0.009	-0.003	-0.005	-0.004
140	-0.011	-0.004	-0.007	-0.005
150	-0.013	-0.005	-0.008	-0.006
160	-0.016	-0.006	-0.009	-0.007
170	-0.018	-0.008	-0.010	-0.008
180	-0.020	-0.009	-0.013	-0.010
190	-0.024	-0.011	-0.016	-0.011
200	-0.028	-0.013	-0.018	-0.013
210	-0.034	-0.015	-0.022	-0.015
220	-0.039	-0.017	-0.025	-0.017
230	-0.044	-0.020	-0.029	-0.020
240	-0.050	-0.023	-0.033	-0.023
250	-0.057	-0.027	-0.038	-0.026
260	-0.065	-0.030	-0.043	-0.030
270	-0.071	-0.034	-0.048	-0.033

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
280	-0.080	-0.037	-0.054	-0.037
290	-0.087	-0.041	-0.060	-0.041
300	-0.095	-0.045	-0.065	-0.045
310	-0.102	-0.049	-0.070	-0.048
320	-0.110	-0.052	-0.075	-0.052
330	-0.116	-0.056	-0.080	-0.055
340	-0.122	-0.059	-0.084	-0.058
350	-0.128	-0.062	-0.089	-0.060
400	-0.155	-0.076	-0.108	-0.073
450	-0.175	-0.086	-0.123	-0.084
500	-0.193	-0.095	-0.137	-0.093
550	-0.209	-0.103	-0.149	-0.101
600	-0.222	-0.111	-0.159	-0.109
650	-0.203	-0.101	-0.144	-0.102
700	-0.180	-0.090	-0.129	-0.090
750	-0.160	-0.080	-0.113	-0.080
800	-0.141	-0.070	-0.100	-0.071
850	-0.124	-0.062	-0.088	-0.063
900	-0.112	-0.054	-0.078	-0.056
950	-0.099	-0.049	-0.069	-0.050
1000	-0.088	-0.043	-0.061	-0.045
1100	-0.072	-0.035	-0.050	-0.037
1200	-0.060	-0.029	-0.042	-0.031
1300	-0.052	-0.025	-0.036	-0.027
1400	-0.047	-0.022	-0.032	-0.024
1500	-0.041	-0.020	-0.029	-0.022
1600	-0.038	-0.018	-0.026	-0.020
1700	-0.036	-0.017	-0.023	-0.019

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 15% (92-0130A)
Time is 08:36:23.08.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
1800	-0.031	-0.015	-0.022	-0.017
2000	-0.027	-0.014	-0.020	-0.015
2200	-0.025	-0.012	-0.017	-0.014
2400	-0.024	-0.012	-0.016	-0.013
2600	-0.022	-0.011	-0.015	-0.012
2800	-0.021	-0.011	-0.015	-0.012
3000	-0.020	-0.010	-0.014	-0.011
3200	-0.019	-0.009	-0.014	-0.011
3400	-0.019	-0.009	-0.013	-0.011
3600	-0.019	-0.009	-0.013	-0.010
3800	-0.017	-0.009	-0.013	-0.010
4000	-0.017	-0.009	-0.013	-0.010
4200	-0.016	-0.009	-0.013	-0.010
4400	-0.015	-0.009	-0.013	-0.010
4600	-0.017	-0.009	-0.013	-0.011
4800	-0.017	-0.009	-0.013	-0.010
5000	-0.015	-0.009	-0.013	-0.010
5200	-0.015	-0.009	-0.013	-0.010
5400	-0.016	-0.009	-0.013	-0.010
5600	-0.015	-0.009	-0.013	-0.010
5800	-0.015	-0.009	-0.013	-0.010
6000	-0.016	-0.009	-0.013	-0.010
6200	-0.015	-0.009	-0.013	-0.010
6400	-0.015	-0.009	-0.013	-0.010
6600	-0.016	-0.009	-0.013	-0.010
6800	-0.015	-0.009	-0.013	-0.010
7000	-0.016	-0.009	-0.013	-0.010
7200	-0.016	-0.009	-0.013	-0.010

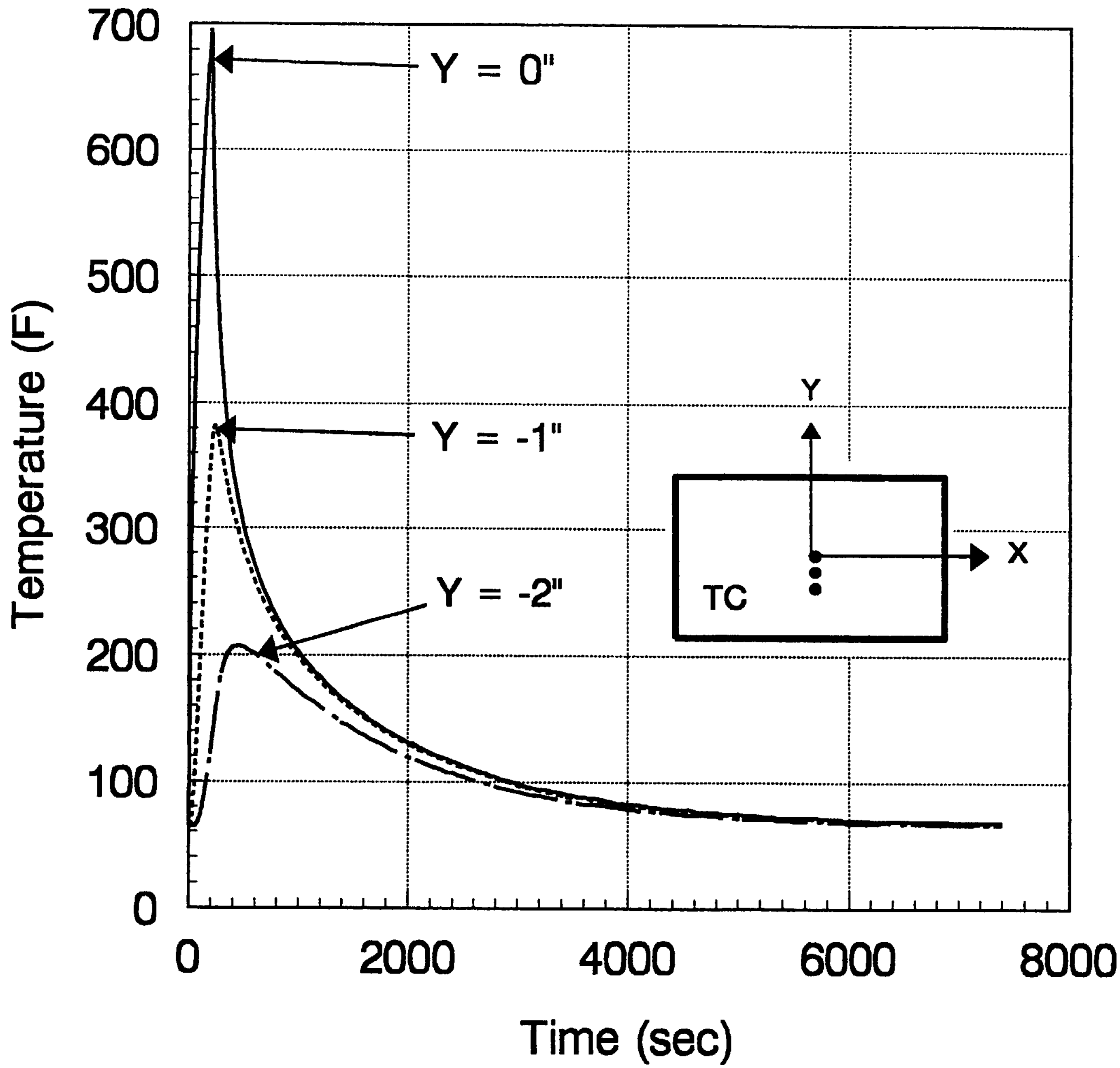
APPENDIX B4

TEST 4 RESULTS

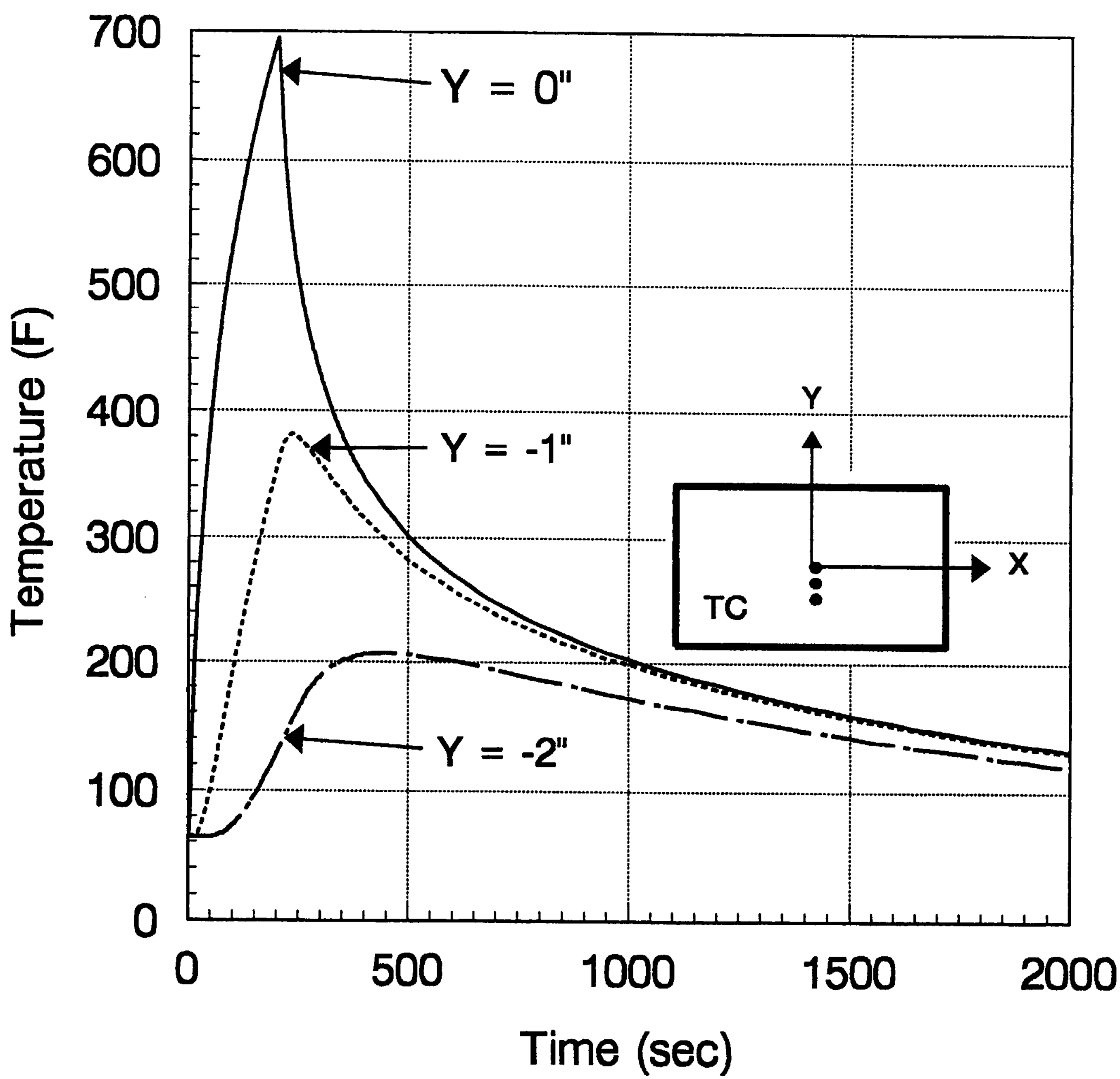
TEST CONDITIONS:

Lamp Power:	30% (1.541 Btu/s)
Max Temperature:	700°F
Heat Flux Duration:	200 s
Behavior:	Plastic

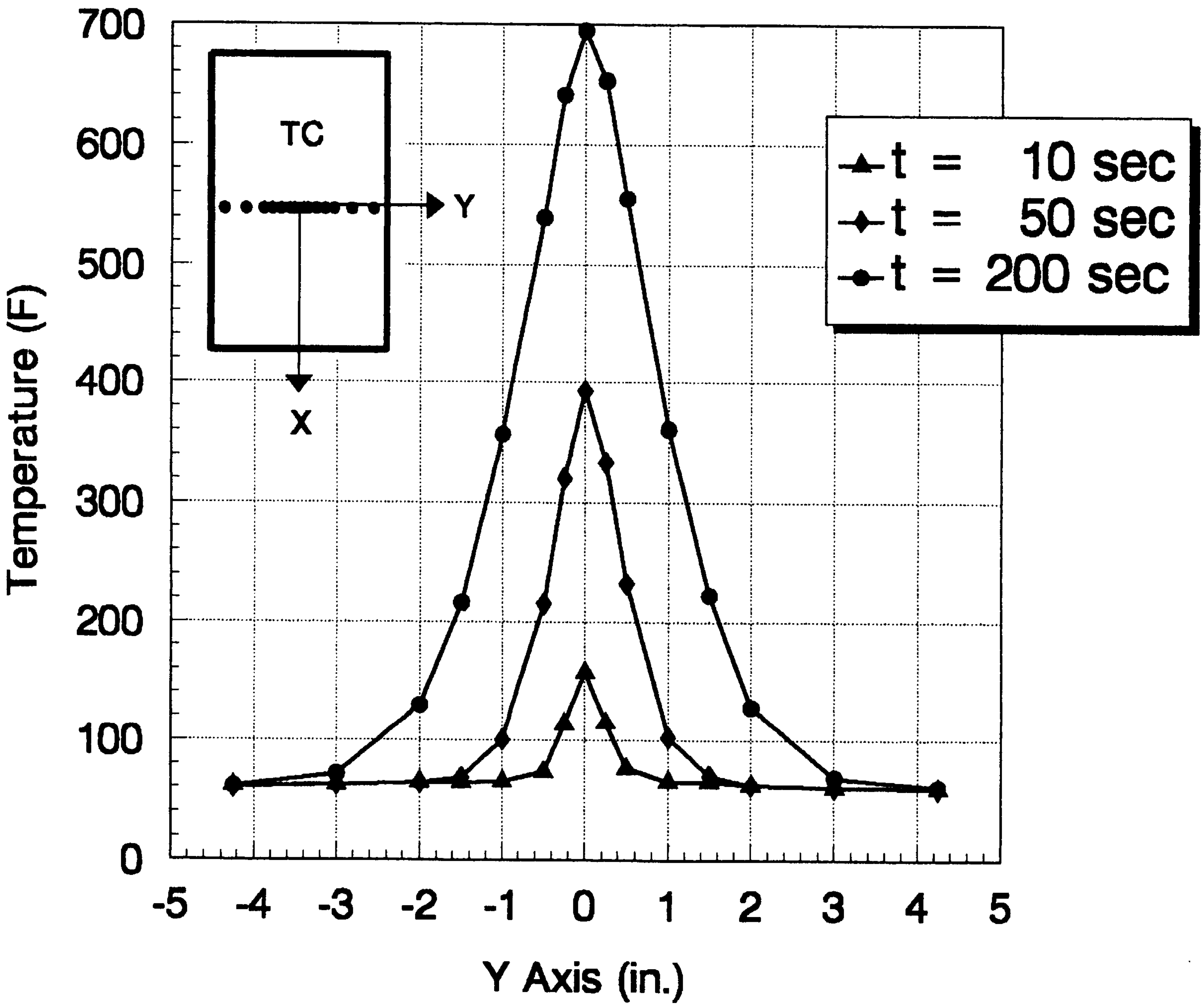
TEST 4 - Panel Temperature History



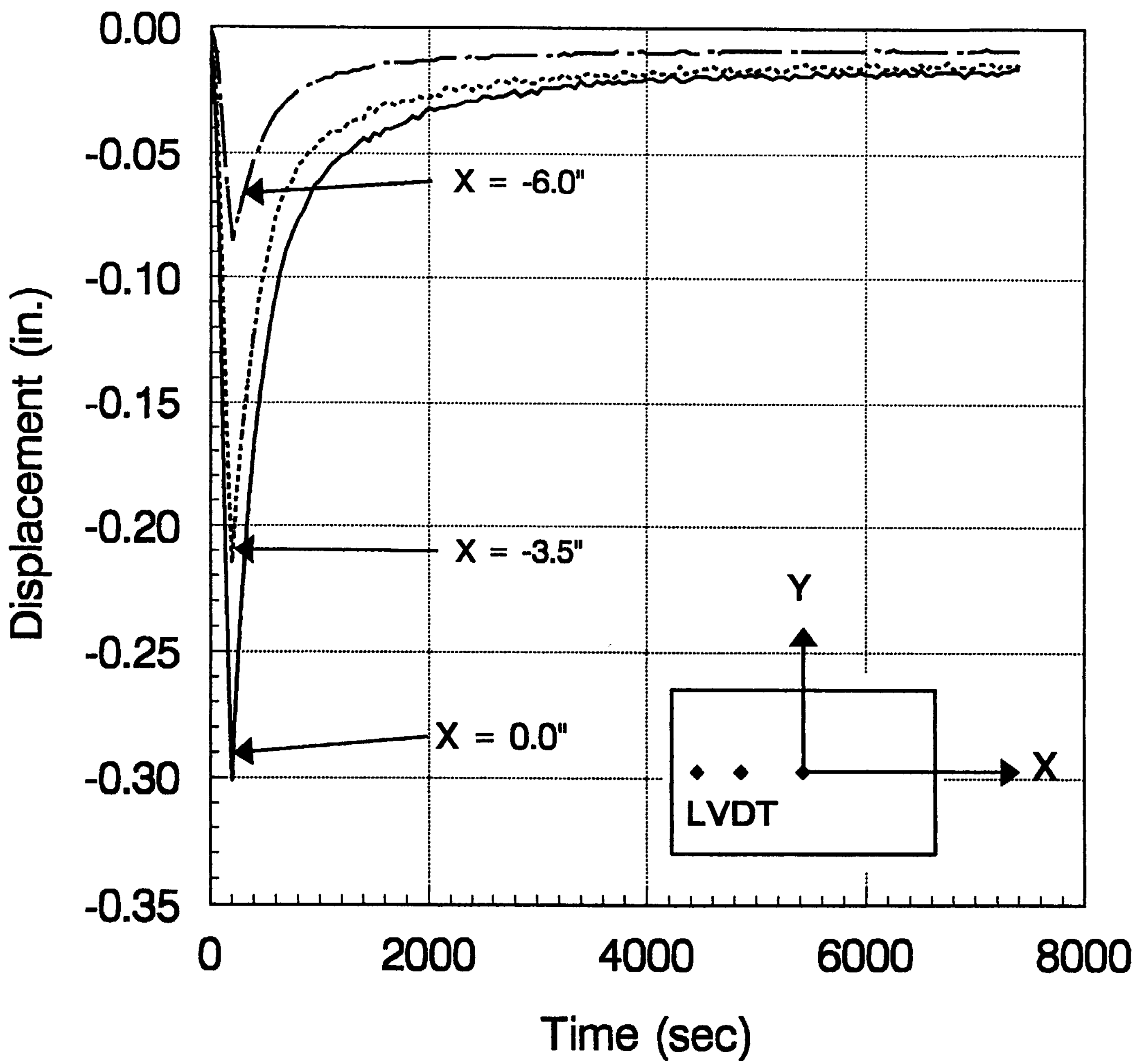
TEST 4 - Panel Temperature History

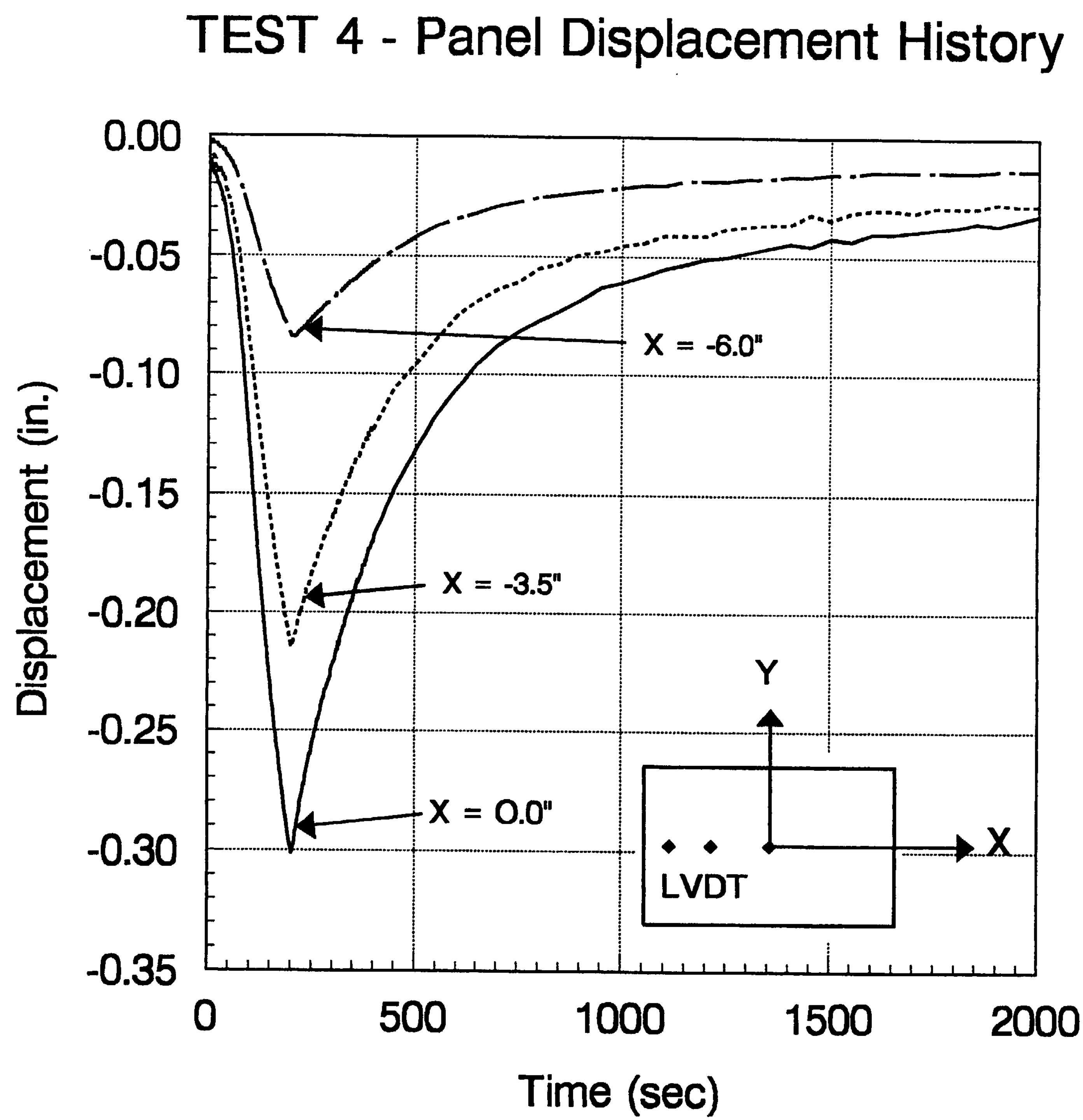


TEST 4 - Panel Temperature Distributions

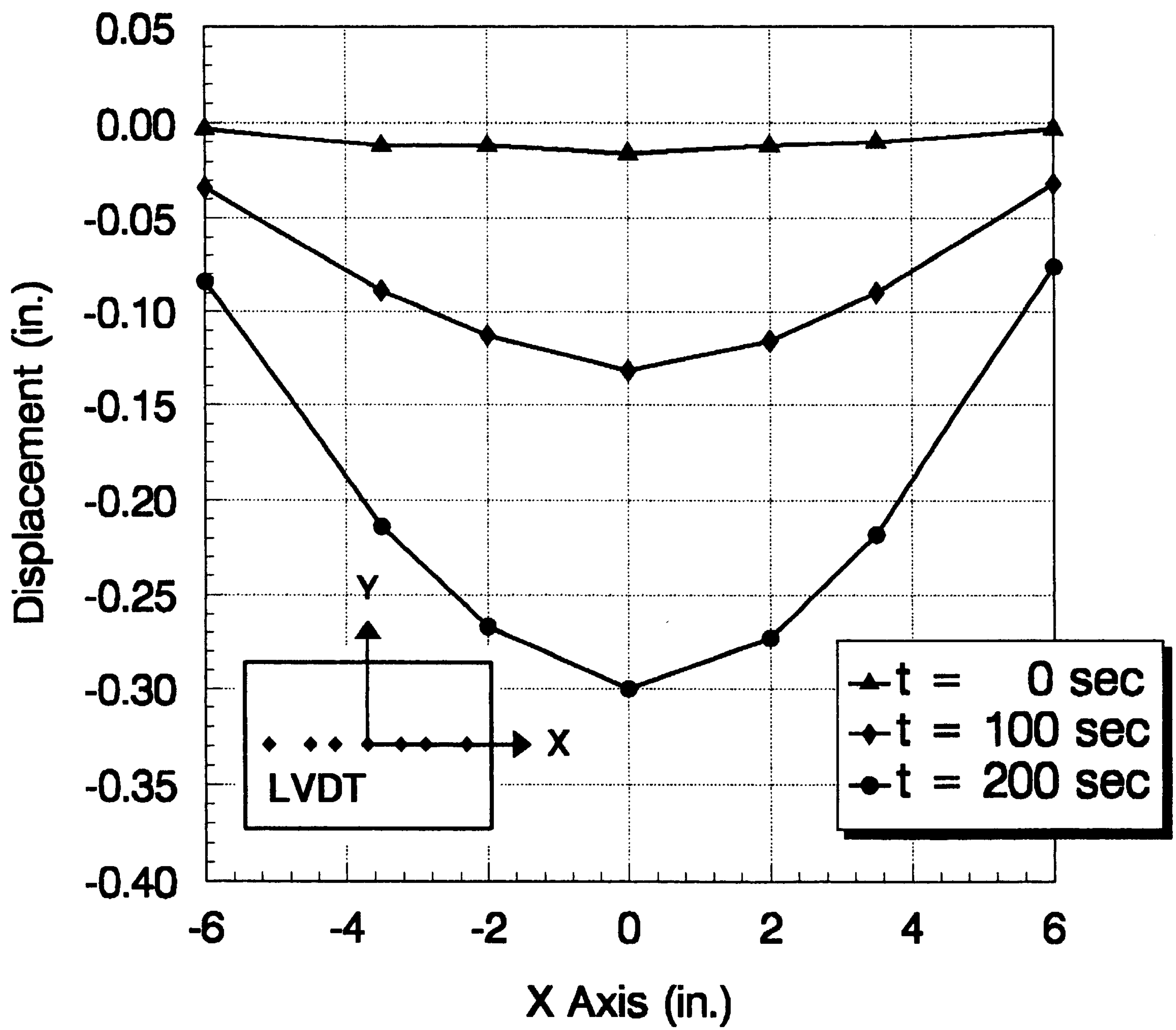


TEST 4 - Panel Displacement History

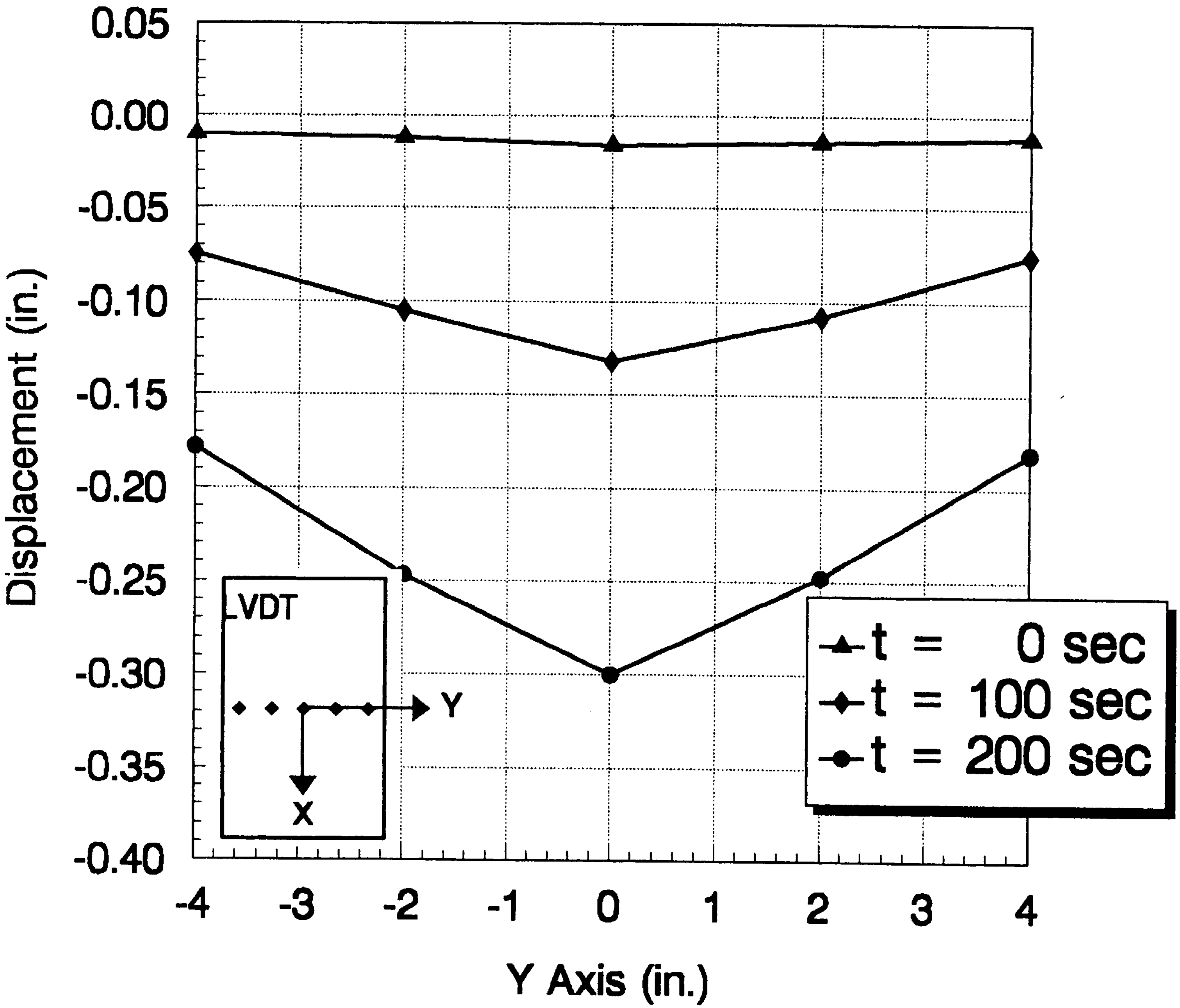



TEST 4 - Panel Displacement History
Displacement (in.)
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
0
500
1000
1500
2000
Time (sec)
X = -6.0"
X = -3.5"
X = 0.0"
Y
X
LVDT

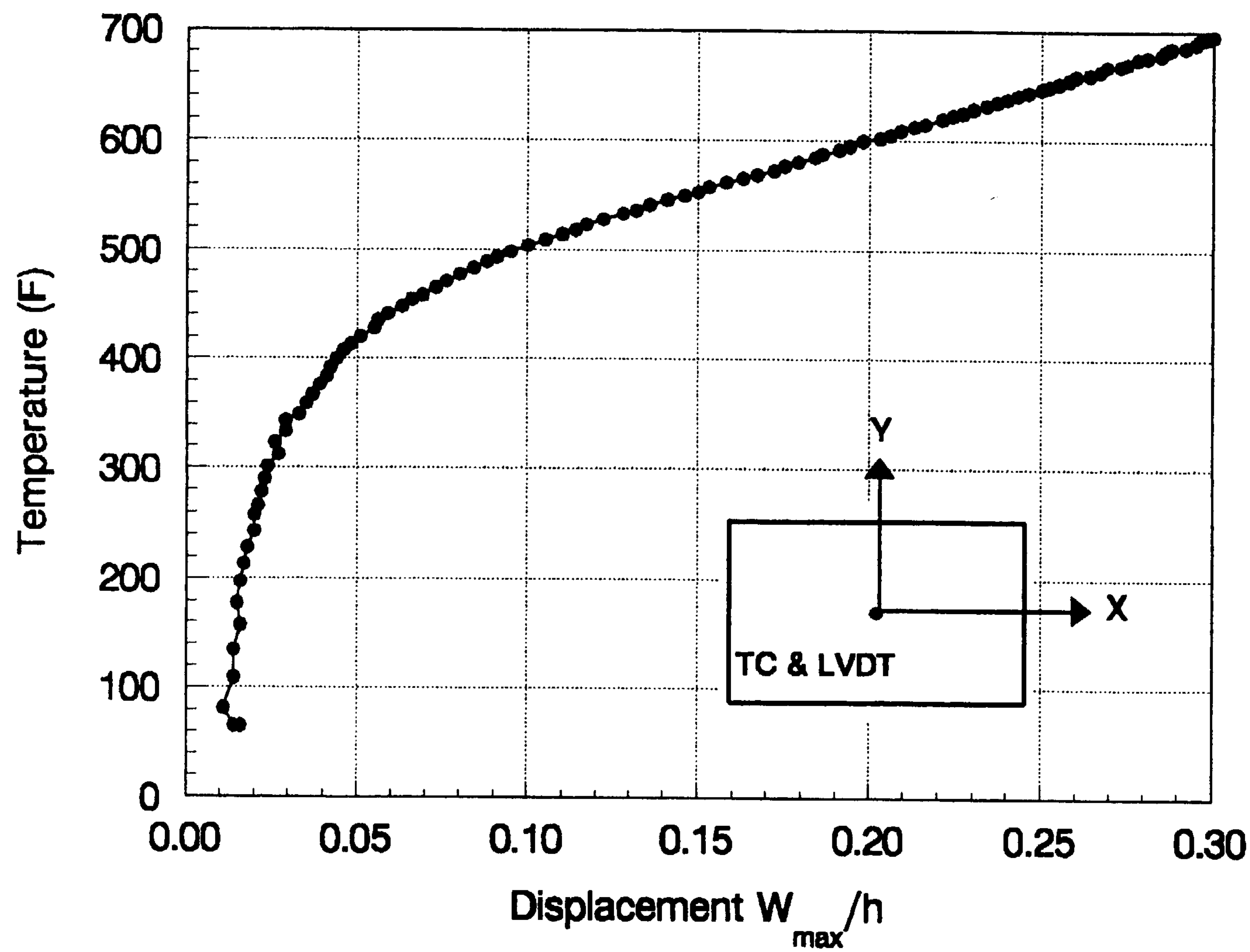
TEST 4 - Panel Displacement Distributions



TEST 4 - Panel Displacement Distributions



TEST 4 - Panel Center Temperature Versus Displacement



TEST 4; PAGE 1 OF 20

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
0	60	62	64	64	64	64	65	67	67	66	66
10	61	62	64	64	65	73	113	148	157	159	157
20	60	62	64	64	67	107	180	227	243	244	241
30	61	62	64	65	73	143	232	284	300	301	298
40	61	62	64	66	85	181	280	334	350	351	348
50	60	62	64	68	100	215	320	373	390	390	388
60	60	62	65	73	117	248	354	408	424	426	422
70	60	62	66	79	135	279	388	441	455	457	453
80	60	62	67	86	154	307	417	470	486	487	482
90	60	62	70	94	172	334	444	496	512	513	508
100	60	62	73	104	192	358	470	519	536	536	529
110	60	62	77	114	211	380	491	540	556	556	550
120	60	63	80	124	227	402	512	561	576	577	568
130	60	63	85	135	246	423	531	579	595	596	586
140	60	64	90	147	264	442	550	597	613	615	602
150	60	65	96	158	280	461	568	612	628	631	617
160	60	66	102	169	296	478	584	628	643	647	632
170	60	67	108	182	312	494	600	643	658	662	646
180	61	67	115	193	328	509	613	655	671	675	658
190	61	69	121	204	341	525	627	668	685	689	671
200	61	71	129	216	356	539	641	680	697	700	682
210	61	73	134	227	368	538	605	612	624	634	620
220	61	74	142	237	377	521	568	560	573	584	572
230	61	76	149	248	381	503	541	525	538	550	541
240	61	78	156	256	381	487	516	493	508	522	514
250	61	81	163	262	379	471	495	469	485	499	492
260	61	84	169	267	376	457	477	447	464	480	473
270	61	86	175	270	372	444	462	428	447	463	457

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
280	61	89	180	273	367	433	448	411	431	447	442
290	62	91	185	274	363	422	435	397	417	435	429
300	62	94	188	275	358	412	424	384	405	422	417
310	62	97	192	275	353	403	414	372	393	411	406
320	63	100	194	275	348	394	404	360	383	402	397
330	63	102	197	275	344	386	395	351	373	392	388
340	64	105	199	274	340	378	386	341	364	384	379
350	65	107	201	273	335	372	378	333	356	376	372
360	65	110	202	272	331	365	372	324	348	368	365
370	66	112	203	270	327	359	365	317	341	360	358
380	66	115	204	269	323	352	359	310	334	354	352
390	67	117	205	268	318	346	352	304	328	347	346
400	67	119	206	266	315	341	346	297	323	342	341
450	70	128	207	259	298	318	322	271	297	317	317
500	73	134	206	250	282	300	301	250	276	296	298
550	75	138	203	242	270	283	285	233	259	280	282
600	77	141	201	234	258	270	271	220	245	265	267
650	79	143	198	228	248	258	259	208	233	253	256
700	80	143	194	221	239	247	249	198	221	242	245
750	80	143	190	214	231	238	239	188	212	232	237
800	81	142	186	208	223	229	230	181	203	223	228
850	81	141	183	203	216	222	222	174	195	215	220
900	81	140	179	198	210	215	215	168	188	208	213
950	80	139	175	193	203	208	208	162	182	202	207
1000	81	137	172	188	199	203	203	157	176	196	202
1100	80	134	165	179	188	192	192	148	166	185	191
1200	80	130	159	172	179	183	183	140	157	175	181
1300	79	126	153	165	171	174	174	134	149	167	173

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
1400	77	122	147	158	164	166	166	128	142	159	165
1500	76	119	142	151	157	159	159	123	136	152	158
1600	75	114	137	145	151	153	153	118	130	145	151
1700	74	111	132	140	145	147	147	113	125	139	145
1800	74	108	128	135	139	141	141	110	121	134	139
1900	73	105	124	130	134	136	136	107	117	130	134
2000	72	102	119	126	130	131	131	104	113	125	130
2100	71	100	116	122	125	127	127	102	110	121	126
2200	70	97	112	118	122	123	123	98	107	117	122
2300	70	95	109	114	118	119	119	96	104	113	118
2400	69	93	107	112	114	116	116	95	102	110	114
2500	69	91	104	108	111	112	112	93	99	107	112
2600	68	89	101	105	108	109	109	90	96	104	108
2700	68	88	99	103	106	107	107	89	94	102	106
2800	67	86	96	100	103	104	104	88	93	100	103
2900	67	84	94	98	100	100	100	86	91	97	100
3000	67	83	92	95	97	98	99	85	89	94	98
3100	66	81	90	93	95	96	96	84	88	93	95
3200	66	80	89	91	93	94	94	83	86	91	94
3300	66	79	87	89	91	92	92	82	85	89	92
3400	65	77	85	88	89	90	90	81	83	88	90
3500	65	76	84	86	88	88	88	80	82	87	88
3600	65	76	82	85	87	87	88	79	82	85	87
3700	65	75	82	83	85	86	86	78	81	84	86
3800	65	75	81	82	84	85	85	78	80	82	85
3900	64	74	80	82	82	83	83	77	79	82	83
4000	64	73	78	80	82	82	82	76	78	81	82
4100	64	72	77	79	80	81	81	76	77	80	81

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
4200	63	72	77	78	79	80	80	76	77	78	80
4300	63	71	76	78	78	79	79	75	76	78	79
4400	63	71	75	77	78	78	78	75	76	77	78
4500	62	70	74	76	77	77	78	74	75	77	78
4600	62	69	74	75	76	76	77	74	74	76	77
4700	62	69	74	74	75	75	76	74	74	75	76
4800	63	69	73	74	75	75	75	74	74	75	75
4900	63	69	72	73	74	75	75	73	73	74	75
5000	63	69	71	72	73	74	74	72	73	74	74
5100	62	68	71	72	73	73	73	72	73	73	74
5200	62	67	71	71	72	72	73	72	72	72	73
5300	62	67	71	71	71	72	72	71	71	72	73
5400	62	67	70	71	72	72	72	72	72	72	72
5500	62	67	69	70	71	71	72	71	72	72	72
5600	62	67	69	70	71	71	72	72	72	72	72
5700	62	67	69	70	70	71	71	71	71	71	72
5800	62	66	68	69	70	70	71	71	71	71	71
5900	62	66	68	69	69	70	70	71	70	71	71
6000	62	66	67	68	69	69	69	70	70	70	70
6100	62	66	67	68	69	69	69	70	70	70	70
6200	62	65	67	67	68	69	69	70	70	69	69
6300	62	65	68	68	69	69	69	70	69	69	69
6400	62	65	67	68	69	69	69	69	69	69	69
6500	62	65	67	68	68	69	69	69	69	69	69
6600	62	64	67	67	68	68	69	69	69	69	69
6700	61	64	67	67	68	68	68	69	69	69	69
6800	61	64	66	67	67	68	68	69	69	69	69
6900	61	64	67	67	67	68	68	69	69	69	69
7000	62	64	66	67	67	68	68	69	69	69	69

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
0	65	65	66	66	67	65	65	65	65	62	61
10	157	154	152	146	159	114	76	65	65	62	60
20	243	232	229	220	234	185	112	67	65	62	60
30	301	295	292	280	293	243	155	75	66	61	60
40	349	342	339	327	339	290	193	87	67	62	61
50	392	384	382	368	379	333	232	102	70	62	60
60	428	420	418	403	413	367	265	121	75	63	60
70	458	452	450	434	444	400	295	138	81	64	61
80	489	481	479	462	472	429	323	157	89	66	61
90	514	506	505	488	497	456	349	177	97	68	61
100	536	530	530	513	521	481	374	196	107	71	62
110	558	552	552	535	543	504	398	215	118	77	62
120	577	572	573	555	563	525	420	233	129	80	62
130	595	591	593	575	583	546	440	250	139	84	62
140	613	609	609	593	600	563	459	268	151	89	62
150	629	624	627	609	616	580	477	286	163	95	63
160	644	640	643	626	633	598	495	302	175	101	64
170	658	654	658	641	647	612	511	316	187	107	65
180	670	668	672	656	661	627	527	332	198	114	66
190	684	682	687	670	676	641	542	346	210	120	67
200	695	693	699	683	688	653	555	360	222	127	68
210	634	633	638	621	615	610	550	374	233	134	71
220	586	585	590	574	567	574	530	382	244	141	72
230	552	552	558	541	530	542	509	385	254	149	74
240	525	525	530	514	501	517	491	384	262	155	77
250	502	503	507	491	479	498	475	382	268	162	79
260	482	484	489	473	458	479	460	377	272	169	82
270	466	467	470	456	440	463	447	373	275	174	84

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
280	452	452	456	440	424	449	435	368	278	179	87
290	438	440	442	427	409	436	423	364	279	184	89
300	427	428	430	415	397	424	413	359	280	187	92
310	416	417	419	404	385	414	404	353	280	190	94
320	405	406	409	393	374	404	395	348	280	193	97
330	396	397	398	384	364	395	386	344	279	195	100
340	387	388	390	375	355	386	378	339	278	197	103
350	379	380	382	366	346	378	372	334	276	198	104
360	372	372	374	359	339	371	365	331	275	200	107
370	365	365	367	352	331	365	359	326	274	201	109
380	359	359	360	346	324	358	352	323	272	202	112
390	352	352	353	339	318	352	346	318	271	203	114
400	346	346	347	333	311	346	341	315	270	203	116
450	322	322	322	307	285	322	318	298	261	204	124
500	301	301	301	286	264	301	299	282	252	203	130
550	285	284	284	268	247	285	283	270	245	201	134
600	271	271	269	254	232	271	270	259	237	197	138
650	259	258	256	241	219	259	258	249	229	194	139
700	248	247	245	229	208	249	248	239	222	190	140
750	239	237	234	219	199	239	238	231	216	187	139
800	230	228	226	210	191	230	229	223	210	183	139
850	222	221	218	203	183	222	222	217	204	180	138
900	215	213	210	194	176	215	215	210	199	176	137
950	208	207	203	188	170	209	208	204	194	173	136
1000	203	201	197	182	165	203	203	199	189	169	134
1100	192	190	186	171	155	193	192	188	180	162	131
1200	183	180	176	162	147	183	183	179	173	156	126
1300	174	172	168	154	139	174	174	171	165	150	123

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
1400	166	165	159	146	133	166	166	164	159	145	119
1500	159	157	152	139	128	159	159	157	152	139	116
1600	153	151	146	134	123	153	153	151	146	134	112
1700	147	145	140	129	118	147	147	145	141	130	109
1800	141	139	134	124	113	142	141	139	136	126	106
1900	136	134	130	119	110	136	136	134	131	121	103
2000	131	130	125	115	107	132	132	130	127	118	101
2100	127	126	121	112	104	127	127	126	123	114	98
2200	123	122	117	108	101	124	124	122	119	111	96
2300	119	118	113	105	98	119	119	118	115	108	93
2400	116	114	110	102	96	116	116	115	112	104	92
2500	112	111	107	100	94	112	112	112	109	102	90
2600	109	108	104	97	92	110	109	108	107	100	88
2700	107	106	102	95	90	107	107	106	104	97	86
2800	104	103	100	94	89	104	104	103	100	95	85
2900	101	100	97	91	87	101	101	100	98	93	83
3000	99	98	94	89	86	99	99	98	96	91	81
3100	96	95	93	88	84	96	96	95	94	89	81
3200	94	94	91	86	84	94	94	94	92	87	79
3300	93	92	89	85	82	93	93	92	90	86	78
3400	91	90	88	83	81	91	91	90	88	84	78
3500	89	88	86	82	80	89	89	88	87	84	77
3600	88	87	85	82	79	88	88	87	86	81	75
3700	87	86	83	81	79	87	86	86	85	80	73
3800	85	84	82	80	78	85	85	84	83	80	73
3900	83	83	82	79	77	84	84	83	82	78	72
4000	82	82	81	78	76	82	82	82	81	77	71
4100	82	81	79	77	76	82	82	81	80	77	71

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
4200	80	80	78	77	76	81	80	80	79	76	70
4300	79	79	78	76	75	79	79	79	78	74	70
4400	78	78	77	75	74	78	78	78	78	73	69
4500	78	78	76	75	74	78	78	77	77	73	68
4600	77	77	76	74	74	77	77	77	76	72	68
4700	76	76	75	74	73	76	76	76	75	71	68
4800	76	75	75	74	73	76	76	75	75	71	67
4900	75	75	74	73	73	75	75	75	74	70	67
5000	75	74	74	73	72	75	75	75	74	70	66
5100	74	74	73	72	72	74	74	74	73	68	66
5200	73	73	72	72	71	73	73	73	73	69	65
5300	73	72	72	71	71	73	73	72	72	68	65
5400	72	72	72	72	71	72	72	72	72	68	65
5500	72	72	72	71	71	72	72	72	72	67	65
5600	72	72	71	71	71	72	72	72	72	67	65
5700	72	71	71	71	71	72	72	71	71	66	65
5800	71	71	71	70	71	71	71	71	70	66	64
5900	71	71	70	70	70	71	71	70	70	66	64
6000	70	70	70	70	70	70	70	70	69	66	64
6100	70	70	69	69	70	70	70	69	69	66	64
6200	69	69	69	69	69	69	69	69	69	66	63
6300	69	69	69	69	69	69	69	69	69	66	63
6400	69	69	69	69	69	69	69	69	69	65	63
6500	69	69	69	69	69	69	69	69	69	65	63
6600	69	69	69	69	69	69	69	69	69	66	63
6700	69	69	69	69	69	69	69	69	68	64	63
6800	69	69	69	69	69	69	69	68	68	65	63
6900	69	69	69	69	69	69	69	69	68	65	63
7000	68	68	68	69	69	68	68	68	68	65	63

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
0	61	59	59	59	61	63	63	74	56	59	59
10	60	59	59	59	60	63	63	74	56	59	59
20	60	59	59	59	60	66	65	74	59	59	59
30	60	59	59	59	60	73	72	74	56	59	59
40	61	59	59	59	61	87	86	74	56	59	59
50	60	59	59	60	60	103	102	74	55	59	59
60	60	59	59	59	60	120	119	74	55	59	59
70	61	59	59	59	61	139	137	74	58	59	59
80	61	59	59	59	61	158	157	74	57	59	59
90	61	59	59	59	61	178	176	74	57	59	59
100	61	59	59	59	61	198	196	74	57	59	59
110	61	59	59	59	61	215	214	74	56	59	59
120	61	60	59	59	61	234	233	74	57	59	59
130	61	59	59	59	61	252	251	74	55	59	59
140	61	60	59	60	61	270	269	75	58	59	59
150	61	60	59	60	62	287	285	75	55	59	59
160	60	60	59	60	61	303	301	74	54	59	59
170	60	60	60	60	61	318	317	75	53	59	59
180	60	60	60	60	61	333	332	75	54	59	59
190	60	60	60	60	61	347	346	74	53	59	59
200	61	60	60	60	62	362	361	75	55	59	59
210	61	60	60	60	62	375	374	75	55	60	59
220	61	60	60	60	62	383	382	75	59	59	59
230	61	60	60	60	61	386	385	74	56	59	59
240	61	60	60	60	62	385	384	74	54	59	59
250	61	60	60	60	62	382	381	75	56	59	59
260	62	61	61	61	62	379	377	75	55	59	59
270	62	61	61	62	62	374	372	75	58	59	59

TEST 4; PAGE 10 OF 20

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
280	62	61	61	61	63	369	367	75	58	59	59
290	62	61	61	62	63	364	363	75	56	59	59
300	62	62	62	62	63	359	357	75	59	59	59
310	62	62	62	62	64	354	352	75	59	59	59
320	63	63	63	63	64	349	347	75	56	59	59
330	63	63	64	64	65	344	343	75	57	59	59
340	64	64	64	64	65	340	338	76	57	59	59
350	64	64	65	65	66	335	333	75	55	59	59
360	64	65	66	66	66	331	329	75	57	59	59
370	65	66	66	66	66	327	325	75	55	59	59
380	65	66	67	67	67	322	321	75	57	59	59
390	66	67	67	67	67	318	317	75	59	59	59
400	66	67	68	68	67	315	313	75	59	59	59
450	68	70	71	71	69	297	296	75	55	59	59
500	70	73	74	74	71	282	282	75	57	59	59
550	72	77	78	78	73	269	268	75	59	59	59
600	73	79	80	80	74	257	257	75	58	59	59
650	73	80	81	80	74	247	246	75	58	59	59
700	74	81	82	82	74	238	238	75	60	59	59
750	74	82	82	82	74	229	229	75	55	59	59
800	74	82	83	82	74	222	222	75	54	59	59
850	75	82	84	82	74	216	215	75	52	60	60
900	75	82	84	82	74	209	208	75	58	59	59
950	75	82	84	82	74	203	202	74	59	59	59
1000	74	82	84	82	73	198	197	73	58	59	59
1100	73	81	82	81	72	188	187	74	57	59	59
1200	72	80	82	80	72	179	178	75	60	59	59
1300	72	79	80	78	71	170	169	75	58	59	59

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
1400	71	78	79	77	70	163	163	75	56	59	59
1500	70	77	78	77	69	156	155	75	55	59	59
1600	69	77	77	74	68	150	150	74	55	59	59
1700	69	74	77	73	68	144	144	74	55	59	59
1800	69	74	75	73	68	139	139	75	55	59	59
1900	68	72	74	71	67	134	134	75	56	59	59
2000	68	72	73	71	67	129	128	74	57	59	59
2100	67	71	72	70	66	125	124	75	59	59	59
2200	67	70	71	69	66	121	121	75	58	59	59
2300	66	69	70	69	66	117	117	74	57	59	59
2400	66	69	70	68	66	114	113	74	59	60	59
2500	66	69	69	68	66	111	111	75	57	60	59
2600	66	69	69	68	65	107	107	75	58	60	60
2700	65	67	68	66	65	104	104	74	56	60	60
2800	66	67	67	67	65	102	102	74	55	60	60
2900	65	66	67	66	65	99	99	74	60	60	60
3000	64	66	66	65	64	96	96	74	57	59	59
3100	64	66	66	65	64	94	94	74	56	60	60
3200	64	65	66	65	64	93	93	74	60	60	60
3300	64	65	65	64	64	91	91	74	55	60	60
3400	64	65	65	64	64	89	89	74	57	60	60
3500	64	64	65	64	64	88	88	74	59	60	60
3600	64	64	64	64	64	86	86	74	56	59	59
3700	63	63	64	63	63	85	85	73	57	59	59
3800	63	64	64	63	64	83	83	74	59	60	59
3900	63	64	64	63	63	82	82	75	58	60	60
4000	63	63	63	63	63	80	80	75	59	59	59
4100	63	63	63	62	63	80	80	75	53	60	60

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
4200	63	63	63	62	63	78	78	75	55	60	60
4300	63	62	63	62	63	77	77	76	57	60	60
4400	62	62	62	62	63	77	77	75	58	60	60
4500	62	62	62	62	62	77	77	75	56	60	60
4600	63	62	62	62	63	75	75	75	57	60	60
4700	63	62	62	62	63	74	74	76	56	60	60
4800	62	62	62	61	63	73	73	76	53	60	60
4900	62	62	62	61	63	72	72	76	56	60	60
5000	62	61	61	61	62	72	72	75	60	60	60
5100	62	61	61	61	62	71	71	75	60	60	59
5200	62	61	61	61	62	70	70	75	58	59	59
5300	62	61	61	61	62	70	70	75	60	59	59
5400	62	61	61	61	62	70	70	75	59	59	59
5500	62	61	61	61	62	69	69	75	59	60	60
5600	61	61	61	60	62	69	69	75	56	60	60
5700	61	61	60	60	62	68	68	75	58	60	60
5800	61	60	60	60	62	68	68	76	59	60	60
5900	61	60	60	60	62	67	68	76	57	60	60
6000	61	60	60	60	62	67	67	75	56	60	60
6100	61	61	61	61	62	67	67	75	56	60	60
6200	62	61	61	61	62	67	68	75	56	60	60
6300	62	61	61	61	62	67	67	75	56	60	60
6400	61	61	61	61	61	66	66	75	57	60	60
6500	61	60	60	60	62	66	66	75	59	59	59
6600	62	61	60	60	62	66	66	76	59	60	59
6700	62	61	60	60	62	66	66	75	59	60	59
6800	62	60	60	60	62	66	66	76	57	60	60
6900	61	60	60	60	62	66	66	76	59	60	60
7000	61	60	60	60	62	66	66	76	57	60	60

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
0	-0.006	-0.010	-0.007	-0.012	-0.003	-0.012	-0.012	-0.016	-0.012	-0.010	-0.003
10	-0.006	-0.009	-0.006	-0.012	-0.003	-0.009	-0.014	-0.016	-0.013	-0.010	-0.002
20	-0.007	-0.010	-0.006	-0.015	-0.004	-0.015	-0.014	-0.020	-0.016	-0.012	-0.003
30	-0.008	-0.013	-0.008	-0.019	-0.005	-0.017	-0.021	-0.024	-0.020	-0.017	-0.005
40	-0.011	-0.017	-0.011	-0.027	-0.008	-0.023	-0.026	-0.033	-0.027	-0.021	-0.007
50	-0.015	-0.022	-0.014	-0.032	-0.010	-0.028	-0.034	-0.042	-0.036	-0.028	-0.010
60	-0.020	-0.029	-0.019	-0.043	-0.013	-0.036	-0.046	-0.055	-0.047	-0.036	-0.013
70	-0.026	-0.037	-0.025	-0.056	-0.017	-0.046	-0.058	-0.069	-0.061	-0.046	-0.017
80	-0.034	-0.048	-0.033	-0.071	-0.023	-0.060	-0.074	-0.088	-0.076	-0.059	-0.021
90	-0.042	-0.061	-0.042	-0.089	-0.029	-0.074	-0.093	-0.110	-0.097	-0.074	-0.027
100	-0.052	-0.075	-0.051	-0.105	-0.034	-0.089	-0.113	-0.132	-0.116	-0.090	-0.032
110	-0.062	-0.089	-0.060	-0.125	-0.041	-0.105	-0.133	-0.153	-0.136	-0.106	-0.038
120	-0.071	-0.101	-0.069	-0.142	-0.047	-0.120	-0.150	-0.175	-0.155	-0.122	-0.042
130	-0.079	-0.113	-0.076	-0.159	-0.052	-0.132	-0.169	-0.194	-0.174	-0.135	-0.046
140	-0.087	-0.124	-0.084	-0.175	-0.058	-0.148	-0.185	-0.213	-0.190	-0.148	-0.050
150	-0.094	-0.135	-0.091	-0.188	-0.063	-0.160	-0.201	-0.230	-0.206	-0.162	-0.055
160	-0.102	-0.144	-0.098	-0.202	-0.067	-0.172	-0.216	-0.246	-0.220	-0.174	-0.059
170	-0.108	-0.154	-0.105	-0.214	-0.072	-0.183	-0.229	-0.260	-0.235	-0.185	-0.063
180	-0.114	-0.163	-0.111	-0.225	-0.076	-0.193	-0.243	-0.275	-0.247	-0.197	-0.067
190	-0.120	-0.170	-0.117	-0.238	-0.080	-0.204	-0.254	-0.288	-0.259	-0.207	-0.072
200	-0.126	-0.178	-0.123	-0.247	-0.084	-0.214	-0.267	-0.300	-0.273	-0.218	-0.076
210	-0.124	-0.174	-0.119	-0.241	-0.084	-0.210	-0.259	-0.293	-0.264	-0.212	-0.075
220	-0.120	-0.168	-0.115	-0.233	-0.082	-0.203	-0.250	-0.284	-0.256	-0.205	-0.074
230	-0.116	-0.163	-0.111	-0.226	-0.080	-0.196	-0.243	-0.273	-0.247	-0.198	-0.072
240	-0.112	-0.158	-0.107	-0.220	-0.078	-0.189	-0.235	-0.265	-0.241	-0.192	-0.071
250	-0.109	-0.152	-0.104	-0.213	-0.076	-0.183	-0.227	-0.257	-0.232	-0.187	-0.069
260	-0.105	-0.148	-0.101	-0.207	-0.075	-0.179	-0.221	-0.250	-0.225	-0.181	-0.068
270	-0.102	-0.143	-0.098	-0.201	-0.073	-0.173	-0.214	-0.243	-0.220	-0.176	-0.066

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
280	-0.099	-0.138	-0.094	-0.195	-0.071	-0.168	-0.208	-0.236	-0.212	-0.171	-0.065
290	-0.095	-0.134	-0.092	-0.189	-0.069	-0.163	-0.201	-0.229	-0.206	-0.166	-0.063
300	-0.093	-0.130	-0.089	-0.185	-0.068	-0.159	-0.196	-0.222	-0.201	-0.161	-0.062
310	-0.090	-0.126	-0.086	-0.179	-0.066	-0.156	-0.191	-0.216	-0.194	-0.156	-0.060
320	-0.087	-0.123	-0.083	-0.173	-0.065	-0.151	-0.186	-0.210	-0.189	-0.152	-0.059
330	-0.085	-0.119	-0.081	-0.169	-0.063	-0.147	-0.180	-0.204	-0.185	-0.148	-0.058
340	-0.082	-0.116	-0.079	-0.164	-0.061	-0.144	-0.175	-0.199	-0.179	-0.144	-0.056
350	-0.080	-0.112	-0.076	-0.159	-0.060	-0.139	-0.170	-0.194	-0.174	-0.141	-0.055
360	-0.077	-0.109	-0.074	-0.155	-0.058	-0.135	-0.166	-0.186	-0.169	-0.136	-0.054
370	-0.075	-0.106	-0.072	-0.150	-0.057	-0.132	-0.161	-0.184	-0.165	-0.133	-0.053
380	-0.072	-0.102	-0.070	-0.147	-0.056	-0.128	-0.157	-0.178	-0.160	-0.129	-0.052
390	-0.070	-0.100	-0.068	-0.143	-0.054	-0.125	-0.153	-0.173	-0.157	-0.126	-0.051
400	-0.068	-0.097	-0.066	-0.139	-0.053	-0.123	-0.148	-0.168	-0.153	-0.123	-0.049
450	-0.059	-0.084	-0.058	-0.120	-0.047	-0.106	-0.131	-0.148	-0.135	-0.109	-0.046
500	-0.052	-0.073	-0.051	-0.106	-0.042	-0.096	-0.115	-0.132	-0.119	-0.097	-0.041
550	-0.045	-0.064	-0.044	-0.095	-0.037	-0.085	-0.102	-0.117	-0.107	-0.086	-0.037
600	-0.040	-0.057	-0.039	-0.083	-0.034	-0.075	-0.093	-0.106	-0.097	-0.078	-0.033
650	-0.036	-0.051	-0.035	-0.076	-0.032	-0.069	-0.085	-0.096	-0.089	-0.072	-0.031
700	-0.032	-0.046	-0.032	-0.068	-0.029	-0.064	-0.078	-0.088	-0.081	-0.066	-0.028
750	-0.029	-0.041	-0.028	-0.064	-0.027	-0.061	-0.073	-0.082	-0.073	-0.062	-0.027
800	-0.027	-0.038	-0.026	-0.059	-0.025	-0.055	-0.066	-0.077	-0.070	-0.058	-0.025
850	-0.024	-0.035	-0.024	-0.055	-0.024	-0.053	-0.063	-0.073	-0.065	-0.055	-0.024
900	-0.023	-0.032	-0.022	-0.050	-0.023	-0.049	-0.059	-0.068	-0.063	-0.052	-0.023
950	-0.021	-0.030	-0.021	-0.047	-0.022	-0.048	-0.055	-0.063	-0.059	-0.049	-0.021
1000	-0.019	-0.028	-0.019	-0.045	-0.021	-0.045	-0.053	-0.061	-0.057	-0.047	-0.020
1100	-0.017	-0.025	-0.017	-0.040	-0.020	-0.041	-0.049	-0.055	-0.051	-0.043	-0.019
1200	-0.015	-0.022	-0.015	-0.037	-0.018	-0.041	-0.046	-0.051	-0.049	-0.040	-0.018
1300	-0.014	-0.020	-0.014	-0.036	-0.017	-0.037	-0.041	-0.048	-0.043	-0.039	-0.017

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
1400	-0.012	-0.017	-0.012	-0.030	-0.016	-0.036	-0.040	-0.044	-0.042	-0.036	-0.016
1500	-0.011	-0.015	-0.011	-0.029	-0.015	-0.034	-0.037	-0.042	-0.040	-0.034	-0.015
1600	-0.009	-0.014	-0.010	-0.028	-0.014	-0.030	-0.035	-0.040	-0.038	-0.033	-0.015
1700	-0.009	-0.013	-0.009	-0.027	-0.014	-0.031	-0.034	-0.039	-0.036	-0.031	-0.014
1800	-0.008	-0.012	-0.008	-0.025	-0.014	-0.029	-0.032	-0.037	-0.035	-0.030	-0.014
1900	-0.008	-0.011	-0.008	-0.022	-0.013	-0.027	-0.031	-0.036	-0.032	-0.029	-0.013
2000	-0.006	-0.010	-0.007	-0.022	-0.013	-0.028	-0.030	-0.032	-0.032	-0.028	-0.013
2100	-0.006	-0.009	-0.007	-0.020	-0.012	-0.027	-0.029	-0.032	-0.032	-0.027	-0.013
2200	-0.006	-0.008	-0.006	-0.020	-0.012	-0.024	-0.028	-0.031	-0.030	-0.026	-0.012
2300	-0.005	-0.008	-0.006	-0.020	-0.012	-0.024	-0.026	-0.030	-0.030	-0.026	-0.012
2400	-0.004	-0.007	-0.005	-0.018	-0.011	-0.025	-0.025	-0.029	-0.028	-0.025	-0.012
2500	-0.004	-0.006	-0.005	-0.016	-0.012	-0.024	-0.024	-0.027	-0.027	-0.024	-0.011
2600	-0.004	-0.006	-0.004	-0.018	-0.011	-0.023	-0.024	-0.028	-0.026	-0.024	-0.012
2700	-0.003	-0.005	-0.004	-0.017	-0.011	-0.021	-0.023	-0.027	-0.024	-0.023	-0.011
2800	-0.003	-0.005	-0.004	-0.016	-0.011	-0.020	-0.024	-0.025	-0.026	-0.023	-0.011
2900	-0.003	-0.005	-0.003	-0.015	-0.011	-0.021	-0.023	-0.026	-0.025	-0.022	-0.010
3000	-0.001	-0.004	-0.003	-0.012	-0.011	-0.022	-0.021	-0.026	-0.025	-0.022	-0.011
3100	-0.002	-0.003	-0.003	-0.013	-0.011	-0.021	-0.021	-0.024	-0.023	-0.021	-0.010
3200	-0.002	-0.003	-0.003	-0.013	-0.011	-0.020	-0.022	-0.024	-0.024	-0.021	-0.011
3300	-0.001	-0.003	-0.002	-0.013	-0.011	-0.020	-0.019	-0.023	-0.024	-0.020	-0.011
3400	-0.001	-0.003	-0.002	-0.012	-0.010	-0.020	-0.019	-0.021	-0.023	-0.021	-0.010
3500	-0.001	-0.002	-0.002	-0.010	-0.010	-0.018	-0.019	-0.023	-0.021	-0.020	-0.010
3600	0.000	-0.001	-0.002	-0.011	-0.010	-0.018	-0.017	-0.022	-0.023	-0.020	-0.010
3700	0.000	-0.002	-0.001	-0.012	-0.010	-0.020	-0.018	-0.022	-0.020	-0.020	-0.010
3800	-0.001	-0.002	-0.002	-0.012	-0.010	-0.017	-0.019	-0.022	-0.022	-0.020	-0.010
3900	-0.001	-0.001	-0.001	-0.011	-0.010	-0.019	-0.019	-0.021	-0.020	-0.019	-0.010
4000	0.000	-0.001	-0.001	-0.011	-0.010	-0.019	-0.018	-0.020	-0.020	-0.019	-0.009
4100	0.001	0.000	-0.001	-0.011	-0.010	-0.018	-0.017	-0.021	-0.021	-0.019	-0.010

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
4200	0.000	0.000	-0.001	-0.009	-0.010	-0.018	-0.018	-0.019	-0.020	-0.018	-0.010
4300	0.001	0.000	-0.001	-0.009	-0.009	-0.015	-0.018	-0.021	-0.020	-0.019	-0.010
4400	0.001	0.000	-0.001	-0.010	-0.010	-0.017	-0.016	-0.020	-0.019	-0.018	-0.009
4500	0.001	0.000	-0.001	-0.010	-0.010	-0.016	-0.018	-0.019	-0.020	-0.018	-0.009
4600	0.001	0.000	-0.001	-0.008	-0.009	-0.015	-0.017	-0.020	-0.020	-0.018	-0.009
4700	0.001	0.001	0.000	-0.007	-0.009	-0.017	-0.017	-0.018	-0.020	-0.018	-0.009
4800	0.001	0.000	0.000	-0.007	-0.009	-0.018	-0.017	-0.019	-0.019	-0.018	-0.009
4900	0.001	0.001	0.000	-0.008	-0.009	-0.017	-0.017	-0.019	-0.019	-0.018	-0.010
5000	0.001	0.001	0.000	-0.008	-0.009	-0.017	-0.017	-0.019	-0.018	-0.017	-0.009
5100	0.002	0.001	0.000	-0.009	-0.009	-0.016	-0.017	-0.019	-0.019	-0.018	-0.009
5200	0.001	0.001	0.000	-0.008	-0.009	-0.017	-0.017	-0.019	-0.019	-0.018	-0.009
5300	0.001	0.001	0.000	-0.007	-0.009	-0.016	-0.017	-0.020	-0.019	-0.017	-0.009
5400	0.001	0.001	0.000	-0.009	-0.009	-0.015	-0.017	-0.019	-0.019	-0.018	-0.009
5500	0.002	0.002	0.000	-0.008	-0.009	-0.016	-0.016	-0.019	-0.019	-0.017	-0.009
5600	0.002	0.001	0.001	-0.007	-0.009	-0.015	-0.015	-0.018	-0.018	-0.018	-0.009
5700	0.002	0.002	0.000	-0.008	-0.009	-0.016	-0.016	-0.017	-0.018	-0.017	-0.009
5800	0.002	0.002	0.000	-0.006	-0.009	-0.017	-0.015	-0.017	-0.018	-0.017	-0.009
5900	0.002	0.002	0.000	-0.007	-0.009	-0.016	-0.015	-0.018	-0.019	-0.017	-0.009
6000	0.002	0.002	0.001	-0.006	-0.009	-0.014	-0.016	-0.018	-0.019	-0.017	-0.009
6100	0.002	0.002	0.000	-0.007	-0.008	-0.014	-0.016	-0.019	-0.018	-0.017	-0.009
6200	0.002	0.002	0.001	-0.007	-0.009	-0.016	-0.016	-0.018	-0.018	-0.017	-0.009
6300	0.002	0.002	0.000	-0.008	-0.009	-0.016	-0.014	-0.018	-0.018	-0.017	-0.009
6400	0.002	0.002	0.001	-0.007	-0.009	-0.015	-0.016	-0.018	-0.017	-0.017	-0.009
6500	0.002	0.002	0.001	-0.007	-0.009	-0.014	-0.014	-0.016	-0.018	-0.016	-0.009
6600	0.002	0.002	0.001	-0.006	-0.009	-0.014	-0.015	-0.018	-0.017	-0.017	-0.009
6700	0.002	0.002	0.001	-0.007	-0.009	-0.015	-0.016	-0.017	-0.018	-0.017	-0.009
6800	0.002	0.002	0.000	-0.008	-0.009	-0.016	-0.015	-0.017	-0.017	-0.016	-0.009
6900	0.002	0.002	0.001	-0.007	-0.009	-0.015	-0.015	-0.019	-0.017	-0.017	-0.009
7000	0.002	0.002	0.001	-0.006	-0.009	-0.015	-0.013	-0.017	-0.016	-0.016	-0.009

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
0	-0.014	-0.008	-0.012	-0.009
10	-0.014	-0.008	-0.011	-0.009
20	-0.017	-0.008	-0.012	-0.009
30	-0.021	-0.010	-0.015	-0.011
40	-0.026	-0.013	-0.019	-0.014
50	-0.035	-0.017	-0.025	-0.017
60	-0.044	-0.021	-0.030	-0.022
70	-0.056	-0.026	-0.039	-0.028
80	-0.071	-0.034	-0.050	-0.035
90	-0.090	-0.043	-0.062	-0.044
100	-0.108	-0.052	-0.076	-0.053
110	-0.126	-0.062	-0.090	-0.062
120	-0.144	-0.071	-0.102	-0.071
130	-0.160	-0.079	-0.114	-0.078
140	-0.174	-0.087	-0.125	-0.086
150	-0.190	-0.095	-0.136	-0.093
160	-0.202	-0.102	-0.147	-0.101
170	-0.215	-0.108	-0.156	-0.107
180	-0.227	-0.115	-0.164	-0.113
190	-0.238	-0.121	-0.172	-0.120
200	-0.248	-0.126	-0.181	-0.126
210	-0.243	-0.123	-0.176	-0.125
220	-0.235	-0.119	-0.170	-0.120
230	-0.227	-0.115	-0.164	-0.116
240	-0.220	-0.111	-0.159	-0.112
250	-0.213	-0.107	-0.153	-0.108
260	-0.207	-0.104	-0.149	-0.105
270	-0.202	-0.100	-0.144	-0.102

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
280	-0.195	-0.097	-0.139	-0.099
290	-0.189	-0.094	-0.135	-0.096
300	-0.184	-0.091	-0.131	-0.093
310	-0.179	-0.089	-0.127	-0.090
320	-0.174	-0.086	-0.123	-0.087
330	-0.169	-0.084	-0.119	-0.085
340	-0.165	-0.081	-0.115	-0.083
350	-0.160	-0.079	-0.113	-0.081
360	-0.156	-0.076	-0.109	-0.078
370	-0.151	-0.074	-0.106	-0.076
380	-0.147	-0.072	-0.102	-0.074
390	-0.144	-0.070	-0.100	-0.072
400	-0.139	-0.067	-0.097	-0.070
450	-0.121	-0.059	-0.084	-0.062
500	-0.106	-0.051	-0.073	-0.054
550	-0.095	-0.045	-0.064	-0.048
600	-0.084	-0.040	-0.057	-0.043
650	-0.076	-0.035	-0.050	-0.039
700	-0.070	-0.032	-0.045	-0.035
750	-0.064	-0.029	-0.042	-0.032
800	-0.060	-0.027	-0.038	-0.030
850	-0.054	-0.024	-0.035	-0.027
900	-0.052	-0.023	-0.033	-0.026
950	-0.049	-0.021	-0.030	-0.024
1000	-0.045	-0.020	-0.028	-0.023
1100	-0.042	-0.018	-0.026	-0.021
1200	-0.037	-0.016	-0.023	-0.019
1300	-0.036	-0.015	-0.020	-0.017

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
1400	-0.033	-0.013	-0.018	-0.016
1500	-0.030	-0.012	-0.017	-0.015
1600	-0.027	-0.010	-0.015	-0.013
1700	-0.027	-0.010	-0.014	-0.013
1800	-0.025	-0.009	-0.013	-0.012
1900	-0.024	-0.008	-0.012	-0.011
2000	-0.024	-0.008	-0.012	-0.011
2100	-0.023	-0.007	-0.010	-0.010
2200	-0.021	-0.007	-0.010	-0.010
2300	-0.021	-0.006	-0.009	-0.009
2400	-0.019	-0.006	-0.008	-0.009
2500	-0.019	-0.006	-0.008	-0.008
2600	-0.018	-0.005	-0.007	-0.008
2700	-0.017	-0.005	-0.007	-0.008
2800	-0.016	-0.004	-0.006	-0.007
2900	-0.017	-0.004	-0.006	-0.007
3000	-0.015	-0.004	-0.006	-0.007
3100	-0.016	-0.003	-0.005	-0.006
3200	-0.015	-0.003	-0.004	-0.006
3300	-0.016	-0.003	-0.004	-0.006
3400	-0.014	-0.003	-0.003	-0.006
3500	-0.013	-0.002	-0.003	-0.006
3600	-0.013	-0.002	-0.004	-0.005
3700	-0.014	-0.002	-0.003	-0.005
3800	-0.013	-0.002	-0.003	-0.005
3900	-0.013	-0.002	-0.003	-0.005
4000	-0.013	-0.002	-0.002	-0.005
4100	-0.013	-0.001	-0.002	-0.004

SLOWLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 30% (92-0130B)
Time is 12:38:38.12.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
4200	-0.013	-0.001	-0.002	-0.005
4300	-0.011	-0.001	-0.002	-0.004
4400	-0.012	-0.001	-0.002	-0.004
4500	-0.012	-0.001	-0.001	-0.004
4600	-0.012	-0.001	-0.001	-0.004
4700	-0.013	-0.001	-0.001	-0.004
4800	-0.011	0.000	-0.001	-0.004
4900	-0.011	-0.001	-0.001	-0.003
5000	-0.010	0.000	-0.001	-0.004
5100	-0.009	0.000	-0.001	-0.003
5200	-0.011	0.000	-0.001	-0.003
5300	-0.010	0.000	0.000	-0.003
5400	-0.011	0.000	-0.001	-0.003
5500	-0.010	0.000	0.000	-0.004
5600	-0.011	0.000	-0.001	-0.003
5700	-0.011	0.000	-0.001	-0.003
5800	-0.010	0.000	-0.001	-0.003
5900	-0.009	0.000	0.000	-0.003
6000	-0.009	0.000	0.000	-0.003
6100	-0.009	0.000	0.000	-0.003
6200	-0.011	0.000	0.000	-0.003
6300	-0.010	0.000	0.000	-0.003
6400	-0.010	0.000	0.001	-0.003
6500	-0.010	0.000	0.000	-0.003
6600	-0.010	0.000	0.000	-0.003
6700	-0.010	0.001	0.000	-0.003
6800	-0.010	0.000	0.000	-0.003
6900	-0.010	0.001	0.000	-0.003
7000	-0.009	0.000	0.000	-0.003

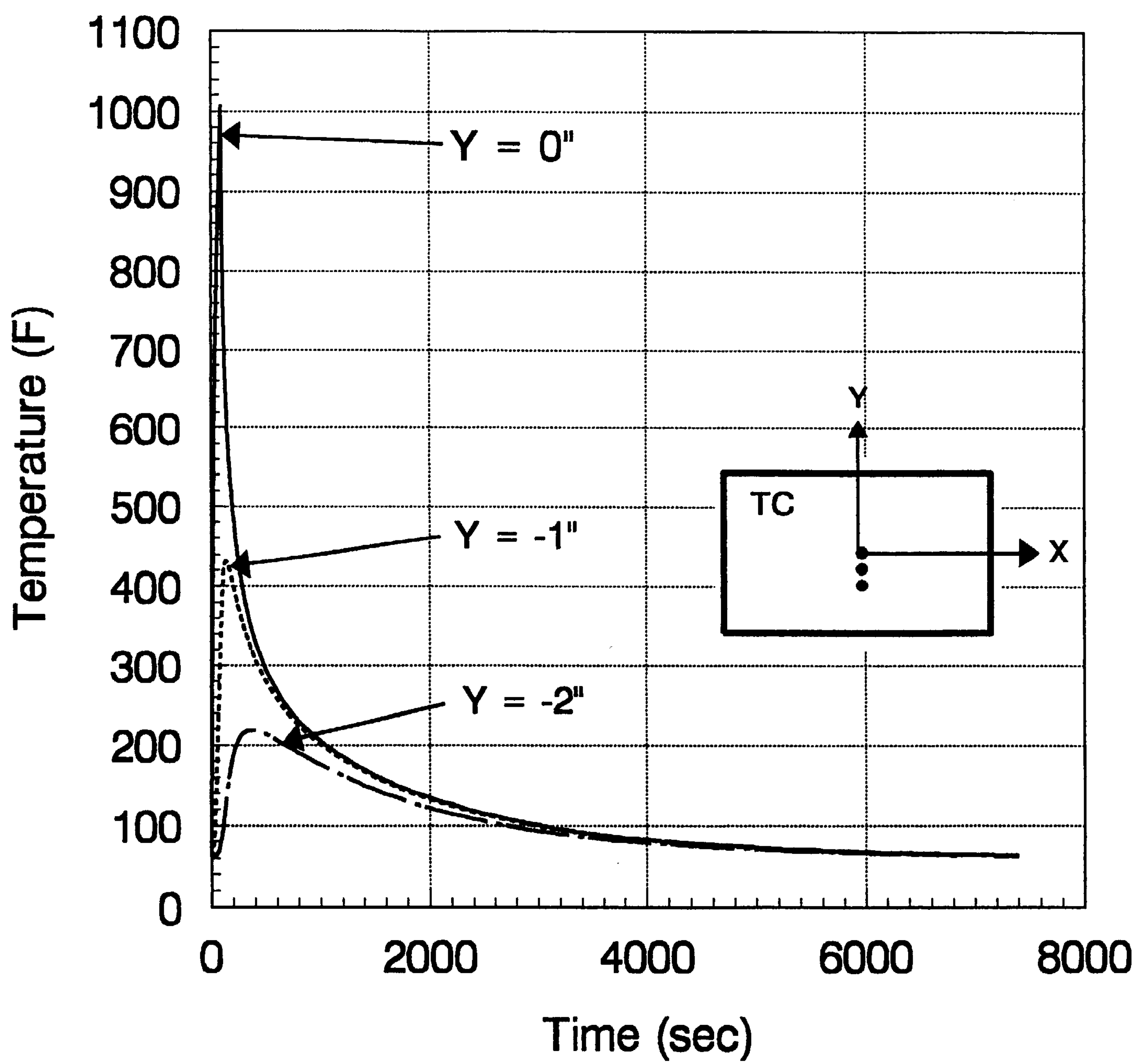
APPENDIX B5

TEST 5 RESULTS

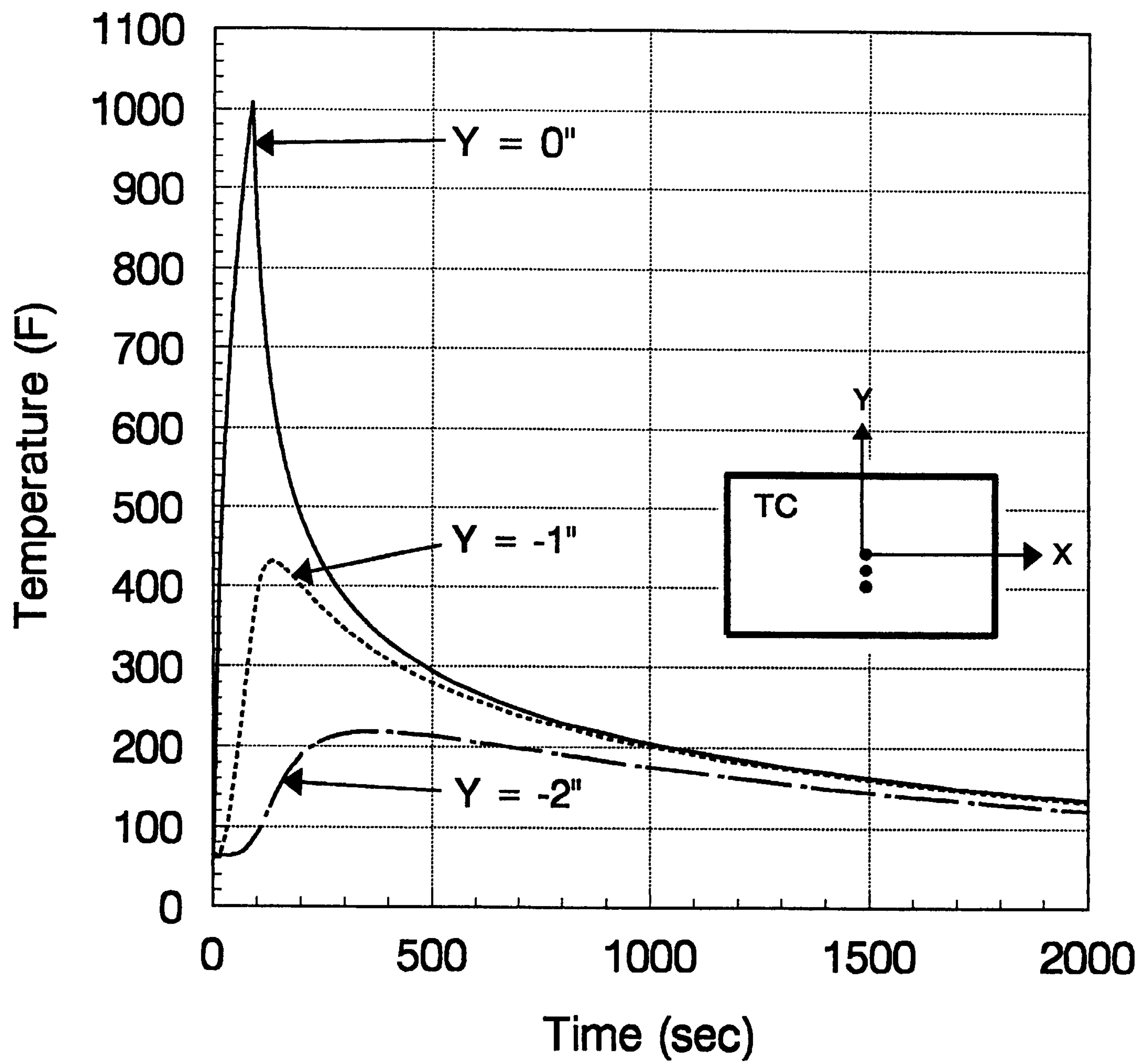
TEST CONDITIONS:

Lamp Power:	70% (3.704 Btu/s)
Max Temperature:	1000°F
Heat Flux Duration:	88 s
Behavior:	Plastic

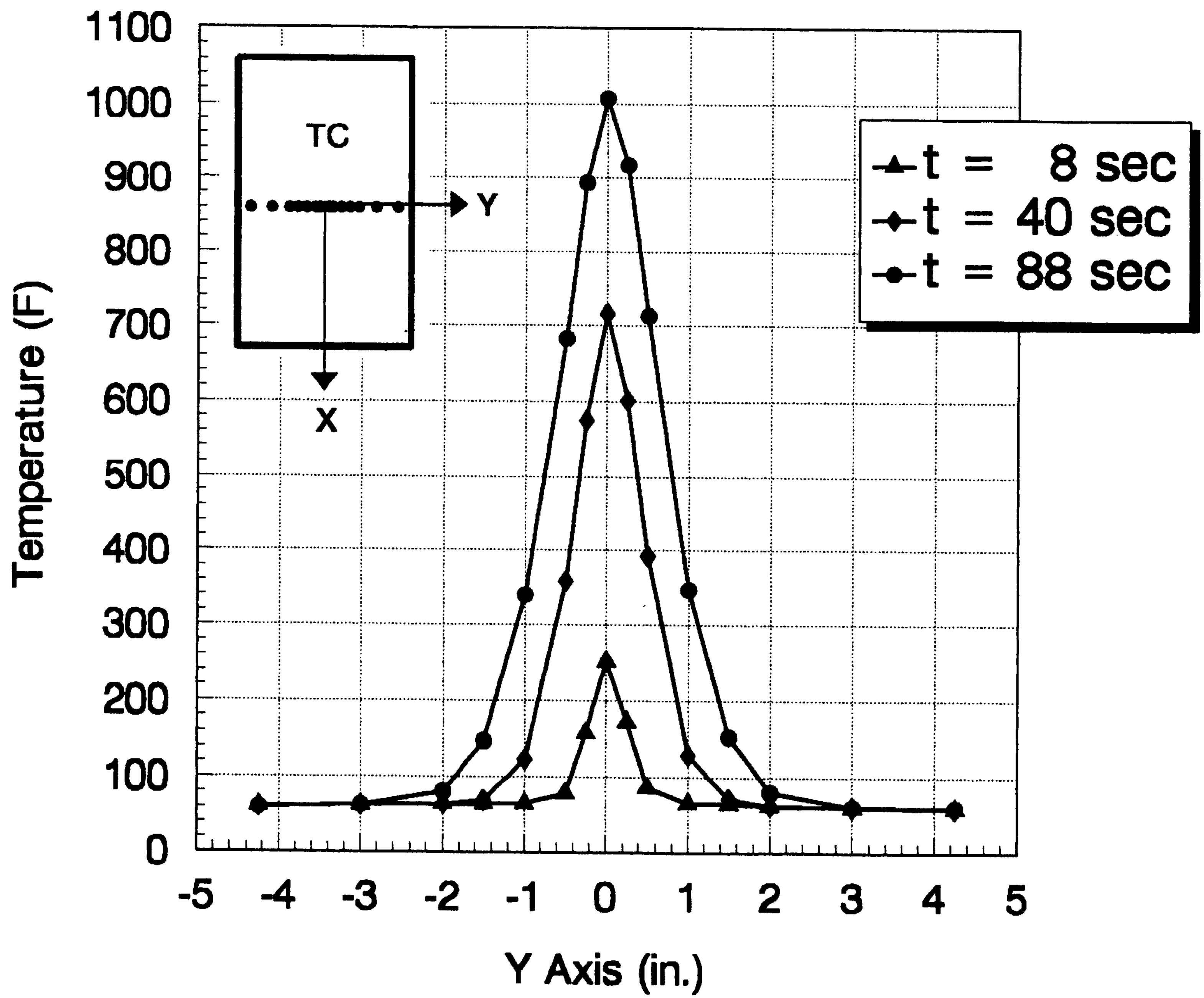
TEST 5 - Panel Temperature History



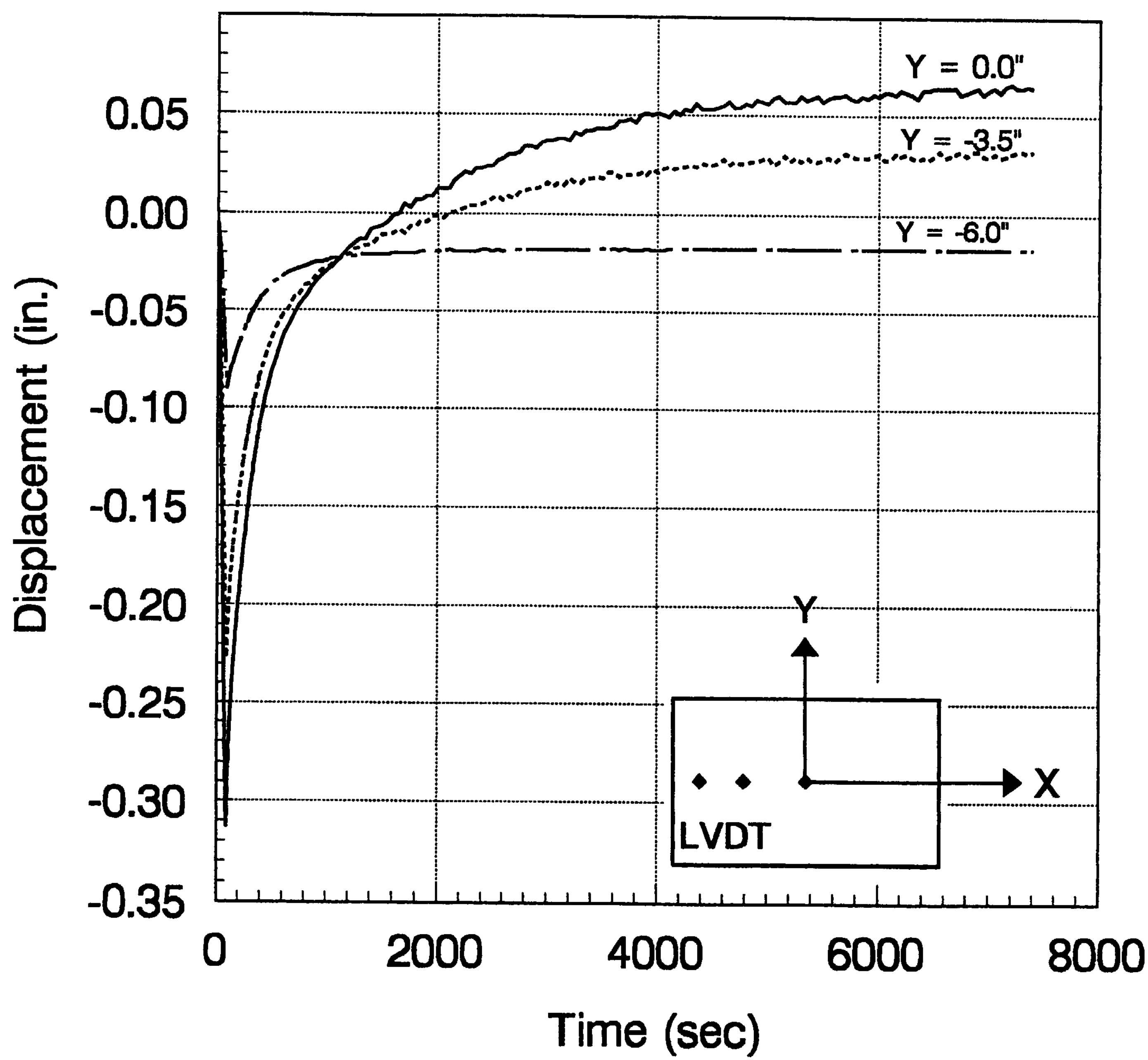
TEST 5 - Panel Temperature History



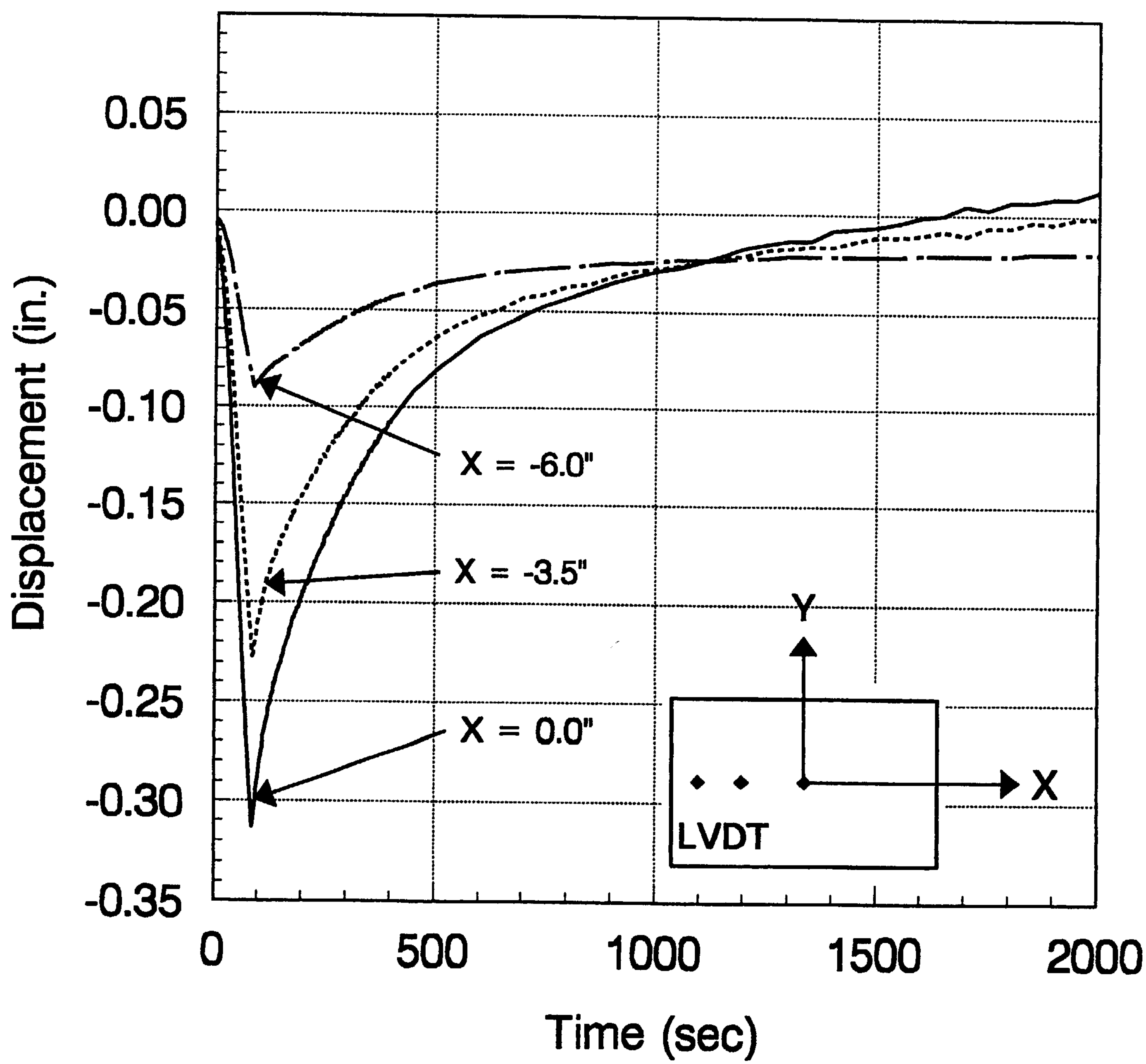
TEST 5 - Panel Temperature Distributions

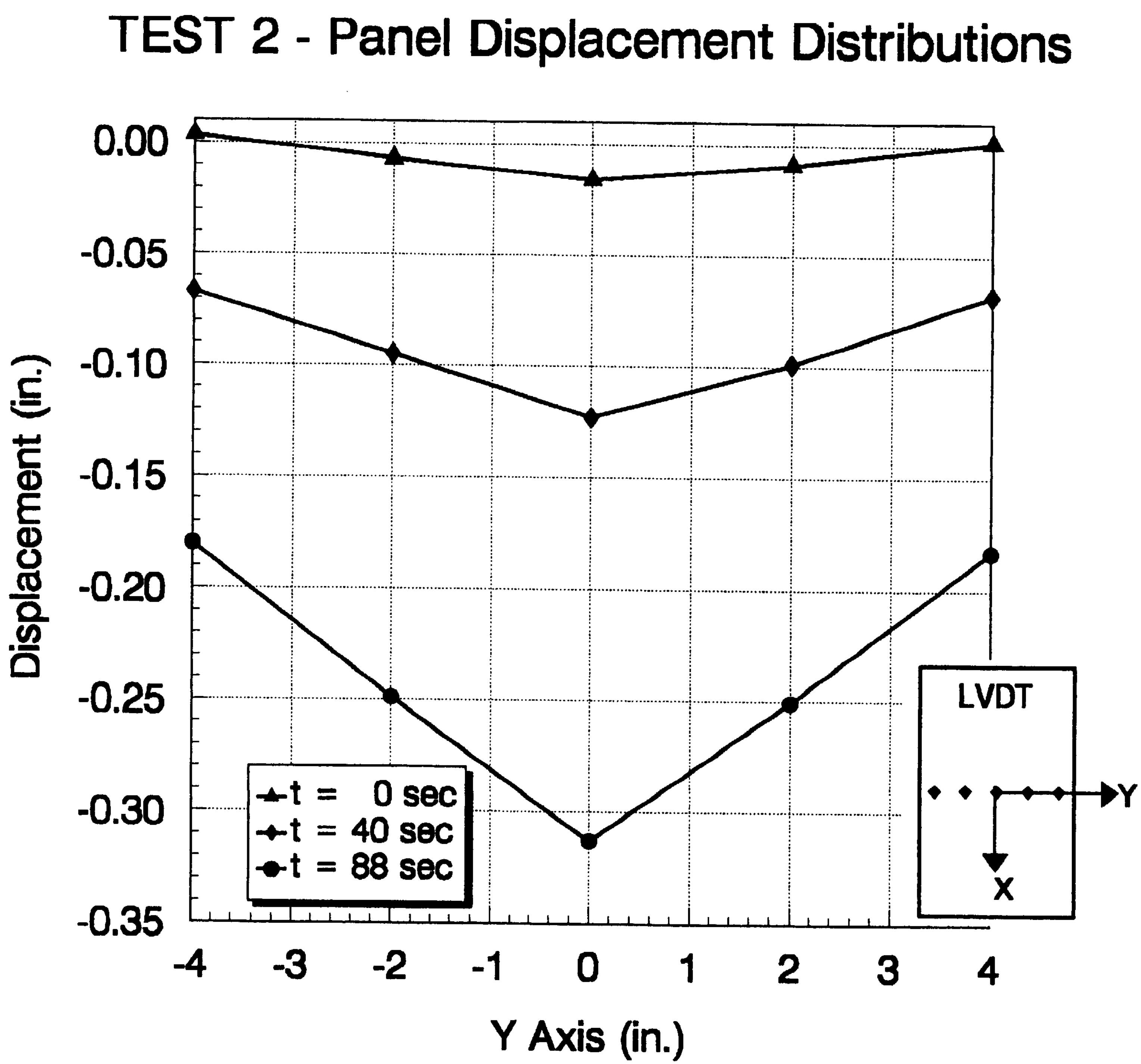


TEST 5 - Panel Displacement History

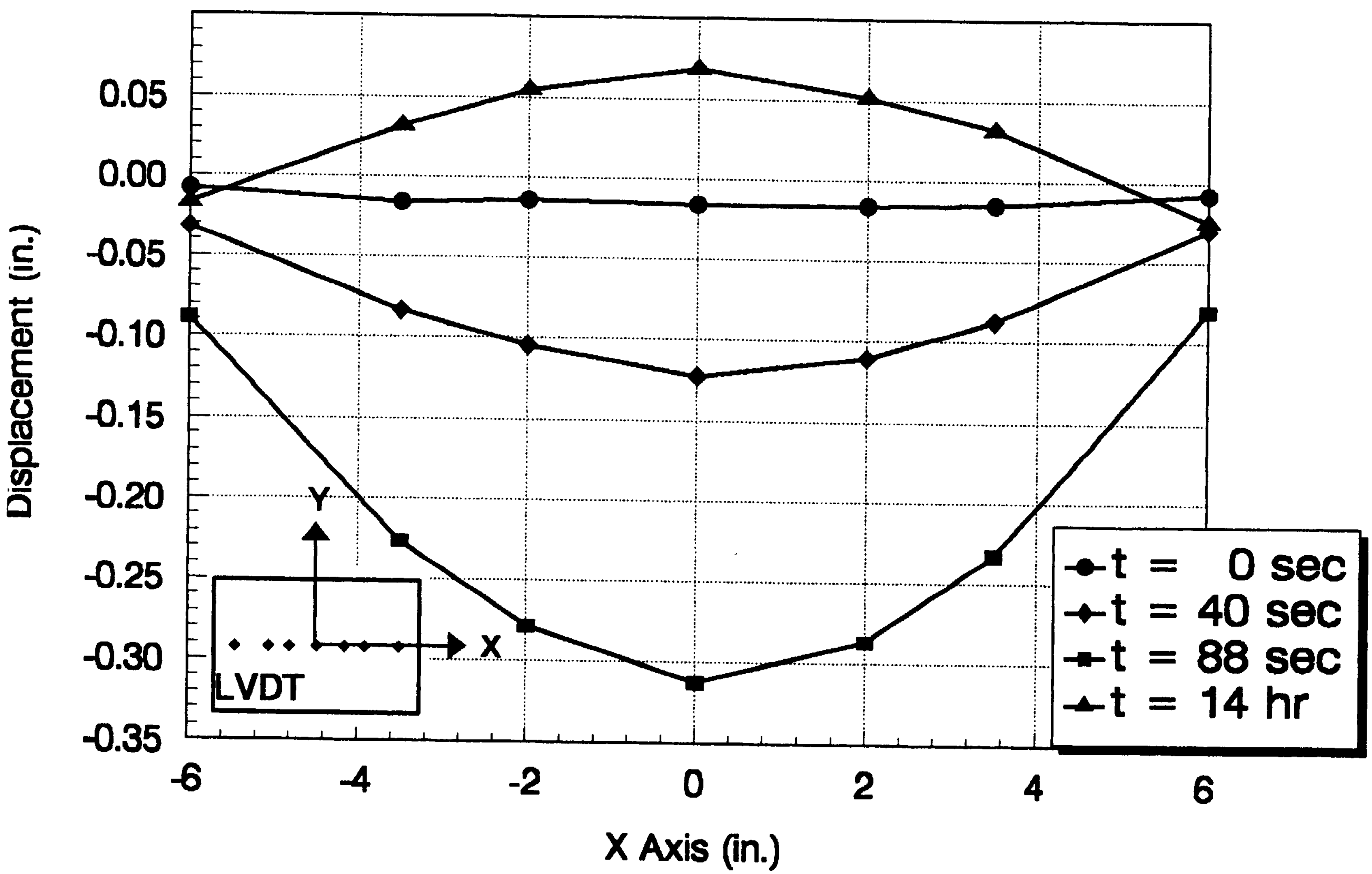


TEST 5 - Panel Displacement History

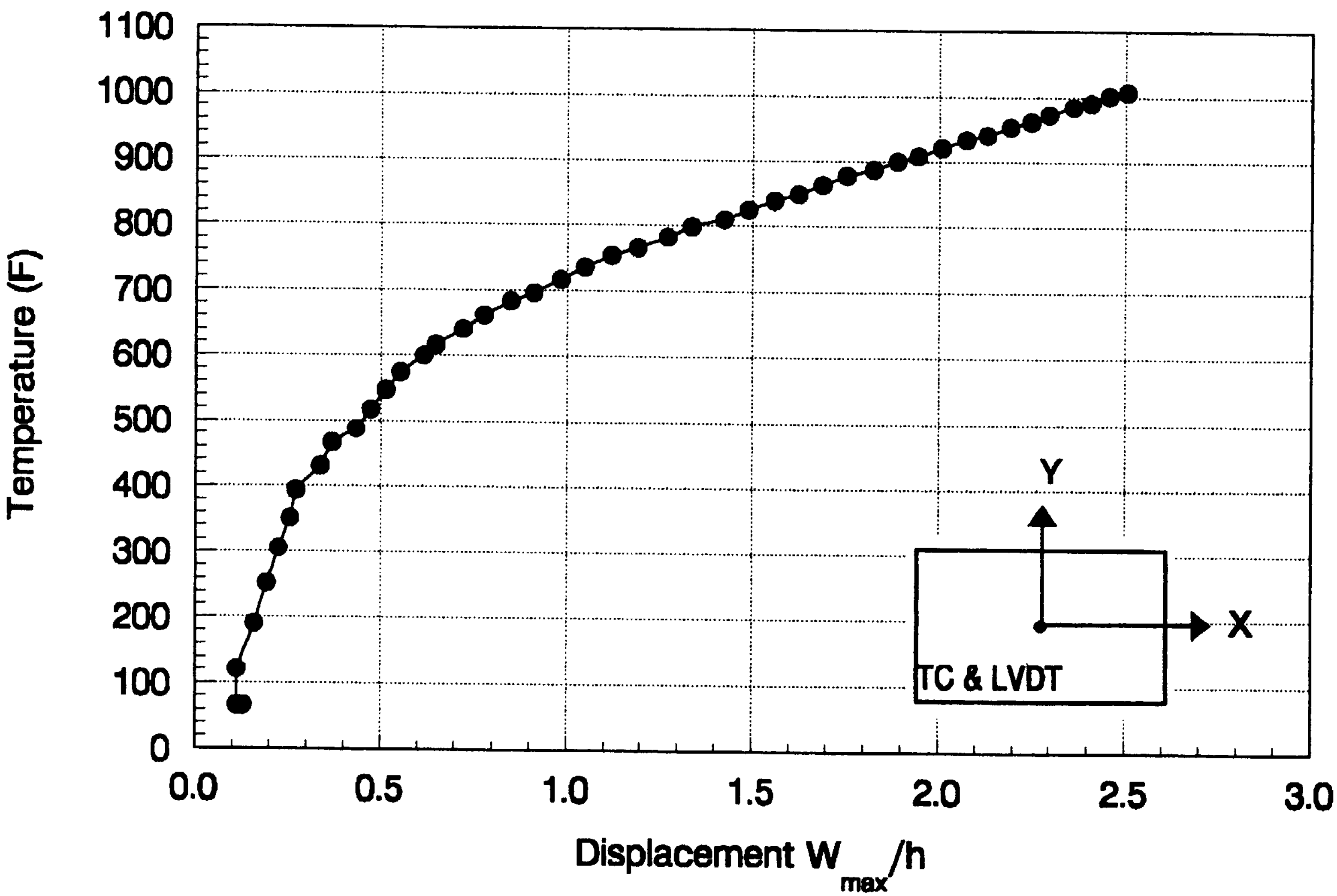



TEST 2 - Panel Displacement Distributions
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
Displacement (in.)
-4
-3
-2
-1
0
1
2
3
4
Y Axis (in.)
t = 0 sec
t = 40 sec
t = 88 sec
LVDT
Y
X

TEST 5 - Panel Displacement Distributions



TEST 5 - Panel Center Temperature Versus Displacement



RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
0	60	62	64	64	64	65	65	67	67	66	66
2	60	62	64	64	65	65	67	73	67	67	66
4	60	62	64	64	64	67	94	111	120	122	121
6	60	62	64	64	65	70	119	171	189	192	190
8	60	62	64	64	65	78	157	226	250	254	251
10	60	62	64	64	65	90	196	274	302	307	303
12	60	62	64	64	65	105	231	317	347	352	347
14	60	62	64	64	66	123	267	357	389	393	389
16	60	62	64	64	67	141	298	393	426	430	425
18	60	62	64	64	69	160	329	427	460	464	459
20	60	62	64	64	72	181	359	459	492	486	481
22	60	62	64	64	75	201	377	479	513	516	511
24	60	62	64	65	78	215	405	508	541	544	539
26	60	62	64	65	82	235	431	534	568	571	566
28	60	62	64	65	87	256	456	560	595	597	591
30	60	62	64	66	92	275	480	584	619	613	607
32	60	62	64	67	96	289	496	601	634	637	631
34	60	62	64	67	103	309	519	624	656	659	652
36	60	62	64	67	110	328	540	646	678	680	674
38	60	62	64	68	117	346	560	666	692	694	686
40	60	62	64	69	123	359	575	680	712	714	706
42	60	62	64	71	131	377	595	700	731	734	725
44	60	62	64	72	140	396	613	719	749	753	743
46	60	62	65	74	149	408	626	732	762	765	754
48	60	62	65	76	155	426	644	750	778	782	771
50	60	62	65	78	165	443	662	768	796	799	788
52	60	62	65	80	174	460	673	779	806	810	797
54	60	62	66	83	181	471	690	796	823	826	813

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
56	60	62	66	85	191	487	706	812	837	841	827
58	60	62	67	88	201	503	717	823	848	851	837
60	60	62	67	90	208	514	732	838	862	866	851
62	60	62	67	94	219	529	747	854	876	880	864
64	60	62	68	98	226	539	757	863	885	889	873
66	60	62	68	100	237	554	771	879	899	902	886
68	60	62	69	104	247	568	786	893	913	916	898
70	60	62	70	107	254	578	795	902	922	924	906
72	60	62	71	111	265	592	808	917	935	937	919
74	60	62	72	116	275	605	821	931	943	945	926
76	60	62	72	119	283	614	830	940	956	957	938
78	60	62	74	124	294	628	843	954	968	969	949
80	60	62	75	128	301	637	851	963	976	978	957
82	60	62	77	132	311	650	863	976	987	988	967
84	60	62	78	138	319	658	871	985	995	995	974
86	60	62	78	142	329	670	883	997	1007	1006	983
88	60	62	80	147	340	683	893	1005	1014	1013	991
90	60	62	82	151	346	689	882	976	980	982	961
100	60	63	90	176	388	682	796	827	828	836	824
110	60	63	101	201	413	653	733	740	744	756	744
120	60	64	112	226	426	622	680	673	679	694	685
130	60	66	124	244	430	596	643	626	636	652	643
140	60	67	137	260	430	571	610	585	597	615	605
150	60	69	148	271	428	549	581	551	567	586	578
160	61	72	158	279	423	531	558	524	540	559	551
170	61	74	168	286	418	513	536	498	518	538	530
180	61	78	175	290	413	498	519	477	497	517	510
190	61	81	182	292	407	483	501	456	478	498	493

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
200	61	84	188	295	400	470	485	438	461	482	478
250	62	101	208	295	372	417	427	372	400	422	418
300	65	116	216	288	347	379	386	328	358	379	379
350	68	128	218	279	326	350	354	296	327	348	349
400	72	136	218	270	308	328	330	271	302	324	325
450	75	142	216	261	293	309	311	252	282	305	307
500	77	145	213	252	280	293	294	236	266	289	290
550	80	148	210	245	268	279	280	222	251	274	277
600	80	149	206	237	258	267	268	211	238	262	265
650	81	149	203	230	249	256	257	201	228	251	255
700	82	149	198	224	239	247	247	192	218	240	245
750	83	149	194	217	232	239	239	184	209	232	236
800	83	147	190	211	225	230	231	178	202	224	229
850	83	146	187	206	219	224	224	171	194	216	222
900	83	144	183	200	212	217	217	165	188	209	215
950	82	142	179	196	206	210	210	160	182	203	209
1000	82	140	175	191	201	204	205	156	176	197	203
1200	80	131	162	175	182	185	185	140	158	177	183
1400	78	124	150	160	167	170	170	128	144	161	168
1600	75	116	139	148	154	156	156	119	133	148	155
1800	74	109	130	137	142	144	144	111	123	137	143
2000	72	104	122	129	133	135	135	105	115	128	133
2200	71	98	115	121	124	126	126	100	109	120	125
2400	69	94	108	113	116	118	118	95	103	112	117
2600	68	90	103	107	111	111	111	92	98	106	111
2800	67	87	98	102	104	105	105	89	94	101	105
3000	66	83	93	97	99	100	100	86	91	97	100
3200	66	81	89	93	94	95	96	83	88	93	95

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T1 in.	T2 in.	T3 in.	T4 in.	T5 in.	T6 in.	T7 in.	T8 in.	T9 in.	T10 in.	T11 in.
X	0.25	0.25	0.25	0.25	0.25	0.25	0.25	-7.44	-5.63	-3.75	-1.88
Y	-4.25	-3.00	-2.00	-1.50	-1.00	-0.50	-0.25	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T1 F	T2 F	T3 F	T4 F	T5 F	T6 F	T7 F	T8 F	T9 F	T10 F	T11 F
3400	65	78	86	88	91	91	92	82	84	88	91
3600	65	76	83	86	88	88	88	80	82	86	88
3800	63	74	81	82	84	85	85	77	80	83	85
4000	63	73	79	81	82	82	82	77	79	82	82
4200	63	71	77	78	79	80	80	76	77	79	80
4400	62	71	75	76	77	77	78	75	76	77	78
4600	62	69	73	75	76	76	76	74	74	76	77
4800	62	68	73	73	74	74	75	73	73	74	75
5000	61	67	71	72	73	73	73	73	73	73	73
5200	61	67	70	70	71	71	72	71	71	72	72
5400	61	66	68	69	69	70	70	70	70	70	71
5600	61	65	67	68	68	69	69	70	69	69	69
5800	61	64	67	68	68	68	69	69	69	69	69
6000	61	64	67	67	67	68	68	69	69	68	68
6200	60	63	66	66	67	67	67	68	67	67	67
6400	60	63	65	65	66	66	66	68	67	67	67
6600	61	62	65	65	65	65	65	68	67	66	66
6800	61	62	64	64	65	65	65	67	67	66	66
7000	61	62	64	64	64	64	64	67	66	65	65
7200	60	62	63	63	63	64	64	67	66	65	64
7400	60	61	63	63	63	63	63	67	65	64	64
FINAL	75	75	75	75	75	75	75	75	75	75	75

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
0	66	66	66	67	67	66	66	65	65	62	61
2	66	66	67	67	70	66	66	65	65	62	61
4	121	120	117	115	132	93	67	66	65	62	60
6	190	186	181	174	197	131	74	66	65	62	61
8	252	245	239	229	255	172	86	66	65	62	60
10	305	297	291	277	304	211	101	66	65	62	61
12	351	341	335	320	347	249	119	66	65	62	61
14	393	383	376	359	386	285	139	67	65	62	60
16	430	419	413	394	422	319	152	67	65	62	60
18	466	454	436	417	444	340	174	70	65	62	60
20	487	475	469	448	474	371	196	72	66	62	61
22	518	507	500	479	504	401	218	76	66	62	61
24	547	535	529	507	532	429	241	80	66	62	60
26	574	562	555	534	558	456	263	83	66	62	60
28	599	588	573	550	575	473	277	88	67	62	61
30	616	604	598	575	598	498	298	94	67	62	60
32	640	628	622	598	621	522	319	100	67	62	60
34	661	650	644	620	643	544	340	107	68	62	60
36	684	672	666	635	656	560	353	112	69	62	61
38	697	685	680	656	677	580	372	120	70	62	60
40	717	706	701	676	697	601	392	128	72	62	60
42	736	725	721	695	717	621	411	134	72	62	61
44	754	738	733	708	729	634	423	143	74	62	61
46	766	756	752	726	747	653	442	152	76	63	60
48	783	773	770	744	764	671	460	163	78	63	60
50	799	784	781	756	776	683	472	169	80	63	60
52	810	801	798	773	793	700	489	179	83	63	60
54	825	816	814	789	809	717	506	189	86	64	60

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
56	840	832	824	800	818	727	517	196	88	64	60
58	849	841	841	815	834	744	533	206	91	65	60
60	864	856	855	831	849	758	549	217	94	65	60
62	878	865	865	841	859	769	559	224	97	66	60
64	887	879	879	855	874	784	574	235	101	66	60
66	900	892	893	869	888	798	589	246	104	66	61
68	909	901	902	879	897	807	598	253	108	67	61
70	921	914	916	892	910	821	613	264	112	68	60
72	933	927	929	906	919	830	622	271	116	69	61
74	940	935	937	915	932	843	636	282	120	70	60
76	953	947	950	928	945	857	650	293	124	71	60
78	961	955	958	936	953	865	659	301	128	72	61
80	972	966	970	949	966	878	671	311	134	73	60
82	983	977	978	957	974	886	680	319	138	75	61
84	990	984	990	969	987	898	693	329	143	77	61
86	1000	995	1000	979	998	910	701	336	147	78	61
88	1007	1002	1008	987	1005	917	713	347	152	80	61
90	979	975	980	957	961	897	721	358	158	82	61
100	842	839	845	823	817	801	700	397	185	89	61
110	762	758	764	744	735	735	664	422	211	100	62
120	699	701	707	687	677	685	631	432	233	112	63
130	658	655	660	642	630	644	600	435	253	124	64
140	620	618	623	605	595	612	576	434	266	135	66
150	591	590	594	576	562	583	553	429	277	147	67
160	565	563	567	550	535	558	533	425	285	157	70
170	543	541	546	529	512	537	515	419	291	165	72
180	523	521	525	508	491	518	498	413	295	174	75
190	504	503	507	492	473	502	485	407	298	180	79

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
200	489	488	492	476	456	486	471	400	300	186	82
250	428	427	429	413	391	427	418	372	299	205	98
300	386	386	386	371	346	386	379	346	292	213	113
350	354	354	354	339	315	354	350	325	282	215	124
400	330	330	329	313	289	330	328	308	272	214	131
450	311	310	310	292	269	311	309	292	263	212	137
500	294	294	292	275	252	294	293	280	255	209	141
550	280	279	277	261	237	281	279	268	246	206	144
600	268	267	265	247	225	268	267	258	239	202	145
650	257	256	254	236	214	258	256	249	231	199	145
700	247	246	244	225	204	247	247	239	224	195	146
750	239	238	234	217	197	239	239	232	219	190	145
800	230	229	227	209	189	231	231	225	213	186	143
850	224	223	219	201	182	224	224	219	207	183	141
900	217	216	212	194	176	217	217	212	202	179	141
950	210	209	205	188	170	211	211	206	197	176	138
1000	205	204	199	182	165	205	205	201	192	171	137
1200	185	184	179	163	148	185	185	182	175	158	129
1400	170	168	163	148	135	170	170	167	161	148	122
1600	156	154	149	136	124	156	156	154	149	137	114
1800	145	142	138	126	115	145	145	142	138	128	108
2000	135	133	128	118	109	135	135	133	130	119	102
2200	127	124	120	111	103	127	126	125	121	113	97
2400	118	116	112	104	98	118	118	117	114	108	94
2600	112	111	106	99	93	112	112	111	108	102	89
2800	106	104	101	95	90	106	106	104	103	97	85
3000	101	99	96	91	87	101	100	99	98	93	83
3200	96	95	92	88	84	96	96	95	93	89	80

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T12 in.	T13 in.	T14 in.	T15 in.	T16 in.	T17 in.	T18 in.	T19 in.	T20 in.	T21 in.	T22 in.
X	0.25	1.88	3.75	5.63	7.44	0.25	0.25	0.25	0.25	0.25	0.25
Y	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.00	1.50	2.00	3.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T12 F	T13 F	T14 F	T15 F	T16 F	T17 F	T18 F	T19 F	T20 F	T21 F	T22 F
3400	92	91	88	84	82	92	92	91	90	86	78
3600	88	88	86	82	80	88	88	88	87	83	75
3800	85	84	82	80	77	85	85	85	83	80	73
4000	83	82	81	78	76	83	83	82	82	78	71
4200	81	80	78	76	75	81	81	80	79	76	71
4400	78	77	76	75	74	78	78	78	77	74	69
4600	77	76	75	74	73	77	77	76	76	72	68
4800	75	74	73	73	73	75	75	75	74	72	68
5000	73	73	73	72	71	73	73	73	73	69	66
5200	72	72	71	70	70	72	72	72	71	68	65
5400	71	70	69	69	69	71	71	70	70	67	64
5600	69	69	68	68	68	69	69	69	69	67	64
5800	69	69	68	68	69	69	69	69	69	66	64
6000	68	68	68	68	68	68	68	68	68	65	64
6200	67	67	67	67	67	67	67	67	67	65	63
6400	67	66	66	67	67	67	67	67	67	65	63
6600	66	65	65	66	66	66	66	66	66	63	62
6800	65	65	65	66	66	65	66	65	66	63	62
7000	64	64	64	65	66	64	65	65	65	63	62
7200	64	64	64	65	65	64	64	64	64	63	61
7400	64	63	64	64	65	64	64	64	64	62	61
FINAL	75	75	75	75	75	75	75	75	75	75	75

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
0	60	59	59	59	61	63	63	75	57	59	59
2	60	59	59	59	61	63	63	75	57	59	59
4	60	59	59	59	61	63	64	75	57	59	59
6	60	59	59	59	60	63	64	75	58	59	59
8	60	59	59	59	60	63	64	75	56	59	59
10	60	59	59	59	60	64	64	75	57	59	59
12	60	59	59	59	61	64	64	75	57	59	59
14	60	59	59	59	61	65	64	75	56	59	59
16	60	59	59	59	60	66	66	75	54	59	59
18	60	59	59	59	61	69	68	75	54	59	59
20	60	59	59	59	60	71	70	75	59	59	59
22	60	59	59	59	61	74	74	75	59	59	59
24	60	59	59	59	61	79	78	75	59	59	59
26	60	59	59	59	61	84	82	75	58	59	59
28	60	59	59	59	61	88	87	75	59	59	59
30	60	60	59	59	60	94	93	75	59	59	59
32	60	60	59	59	60	100	99	75	59	59	59
34	60	60	59	59	60	108	106	75	57	59	59
36	60	60	59	59	61	114	113	75	56	59	59
38	60	60	59	60	61	122	120	76	58	59	59
40	60	60	59	60	61	130	129	75	56	59	59
42	60	60	59	59	61	138	136	75	54	59	59
44	60	60	60	60	61	144	142	76	57	59	59
46	60	60	59	60	61	152	150	75	56	59	59
48	60	60	59	59	61	161	159	76	56	59	59
50	60	60	59	59	61	170	168	75	59	59	59
52	60	60	59	60	61	179	178	75	59	59	59
54	60	59	59	59	61	189	187	76	57	59	59

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
56	60	60	59	60	61	198	196	76	56	59	59
58	60	60	59	59	61	208	206	75	56	59	59
60	60	60	59	59	61	218	216	75	60	59	59
62	60	59	59	59	61	227	225	75	58	59	59
64	60	60	59	60	61	238	235	75	58	59	59
66	60	60	59	59	61	247	245	76	58	59	59
68	60	60	59	60	61	257	254	75	57	59	59
70	60	60	59	60	61	267	264	75	58	59	59
72	60	60	60	60	61	276	274	75	59	59	59
74	60	60	59	59	61	286	284	76	56	59	59
76	60	60	59	60	61	296	293	75	57	59	59
78	60	60	60	59	61	305	303	75	57	59	59
80	60	60	59	60	61	315	313	75	55	59	59
82	60	60	59	60	61	325	322	75	57	59	59
84	60	60	59	60	61	334	332	75	58	59	59
86	60	60	60	60	61	343	340	75	59	59	59
88	60	60	60	60	61	350	347	75	60	59	59
90	60	60	59	60	61	359	356	75	59	60	59
100	60	60	59	59	61	400	398	75	59	59	59
110	60	60	60	60	61	425	423	76	57	59	59
120	60	59	59	59	61	435	432	75	58	59	59
130	60	59	59	60	61	438	435	75	56	59	59
140	60	60	59	60	61	436	434	75	59	59	59
150	60	60	60	60	61	433	429	75	54	59	59
160	60	60	60	60	61	428	424	76	57	59	59
170	60	60	60	60	61	422	419	76	54	59	59
180	60	60	60	60	61	415	412	76	58	59	59
190	61	60	60	60	62	409	406	76	54	59	59

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
200	61	60	60	60	62	403	399	76	60	59	59
250	62	62	62	62	64	372	369	76	56	59	59
300	65	65	66	66	66	347	344	76	58	59	59
350	66	68	69	70	69	326	324	76	59	59	59
400	69	72	73	73	71	308	306	75	58	59	59
450	71	75	77	77	73	292	291	76	55	59	59
500	73	78	79	79	73	279	278	76	55	59	59
550	73	80	81	81	74	267	266	76	54	59	59
600	74	82	82	82	75	256	255	75	57	59	58
650	75	82	84	83	75	247	246	76	55	59	59
700	77	84	85	84	76	239	238	76	57	59	59
750	77	84	85	84	75	231	230	76	56	59	59
800	77	84	85	84	75	224	223	76	58	59	59
850	76	84	85	84	74	217	216	76	55	59	58
900	75	84	85	84	74	211	210	76	58	59	59
950	75	83	85	83	74	206	205	76	54	59	59
1000	74	83	84	83	73	199	199	76	59	59	59
1200	73	80	82	80	71	181	181	76	58	58	58
1400	71	79	80	78	71	166	165	77	54	60	59
1600	70	76	78	75	69	153	152	76	56	59	59
1800	69	74	75	73	68	141	141	77	60	59	59
2000	68	72	73	71	67	132	131	76	58	59	59
2200	68	71	72	69	67	123	123	77	58	59	59
2400	67	70	71	69	67	116	116	78	55	60	60
2600	66	68	68	68	66	110	109	77	57	59	59
2800	65	67	68	67	65	104	104	77	56	59	59
3000	65	66	67	65	64	99	99	76	59	59	59
3200	64	66	66	65	64	94	94	77	57	59	59

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

THERMOCOUPLE LOCATIONS

AXIS	T23 in.	T24 in.	T25 in.	T26 in.	T27 in.	T28 in.	T29 in.
X	-7.25	-3.50	0.25	3.56	7.25	0.25	0.25
Y	4.25	4.25	4.25	4.25	4.25	-1.00	1.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

THERMOCOUPLE READINGS

TIME SEC	T23 F	T24 F	T25 F	T26 F	T27 F	T28 F	T29 F	AMBIENT F	CHILLER F	INLET F	OUTLET F
3400	64	65	65	64	64	90	90	77	58	59	59
3600	64	64	64	63	64	87	87	77	56	59	59
3800	63	64	64	63	63	84	84	76	59	59	59
4000	63	63	63	62	63	81	81	76	59	59	59
4200	63	63	62	62	63	79	79	77	58	59	59
4400	62	62	62	62	62	77	77	77	56	59	59
4600	62	62	62	61	62	74	74	76	57	59	59
4800	63	62	62	62	63	73	73	77	55	60	60
5000	62	61	61	60	62	71	71	77	53	59	59
5200	62	61	61	61	62	69	70	77	54	59	59
5400	62	61	61	60	62	68	68	77	56	59	59
5600	61	60	60	60	62	68	68	76	57	59	59
5800	61	60	60	60	61	67	67	76	57	58	59
6000	61	60	60	60	61	65	66	76	56	59	59
6200	61	60	60	60	61	66	66	77	59	59	59
6400	61	60	60	60	61	65	65	77	60	59	59
6600	61	60	60	60	61	64	64	76	57	59	59
6800	61	60	60	60	61	64	64	77	55	59	59
7000	61	60	59	59	61	63	63	76	59	59	59
7200	61	60	59	59	61	63	63	76	59	59	59
7400	61	60	59	59	61	62	62	76	56	59	59
FINAL	75	75	75	75	75	75	75	75	75	75	75

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
0	0.002	0.003	0.002	-0.007	-0.008	-0.016	-0.014	-0.016	-0.016	-0.015	-0.008
2	0.001	0.001	0.000	-0.005	-0.005	-0.012	-0.013	-0.014	-0.015	-0.013	-0.005
4	0.001	-0.001	-0.001	-0.007	-0.005	-0.014	-0.015	-0.014	-0.017	-0.014	-0.004
6	-0.001	-0.003	-0.003	-0.012	-0.006	-0.014	-0.017	-0.020	-0.018	-0.017	-0.005
8	-0.004	-0.006	-0.005	-0.012	-0.006	-0.017	-0.020	-0.024	-0.023	-0.019	-0.006
10	-0.005	-0.009	-0.007	-0.018	-0.008	-0.022	-0.023	-0.028	-0.026	-0.021	-0.007
12	-0.007	-0.012	-0.008	-0.022	-0.008	-0.023	-0.028	-0.032	-0.030	-0.025	-0.008
14	-0.010	-0.015	-0.010	-0.026	-0.009	-0.026	-0.031	-0.034	-0.034	-0.028	-0.009
16	-0.012	-0.018	-0.012	-0.029	-0.011	-0.029	-0.036	-0.042	-0.037	-0.032	-0.009
18	-0.014	-0.021	-0.015	-0.033	-0.012	-0.032	-0.039	-0.046	-0.043	-0.035	-0.011
20	-0.017	-0.025	-0.017	-0.038	-0.014	-0.037	-0.046	-0.054	-0.049	-0.040	-0.013
22	-0.019	-0.029	-0.020	-0.043	-0.015	-0.040	-0.050	-0.059	-0.052	-0.043	-0.014
24	-0.022	-0.032	-0.022	-0.048	-0.016	-0.044	-0.053	-0.064	-0.059	-0.047	-0.016
26	-0.024	-0.036	-0.024	-0.051	-0.018	-0.049	-0.059	-0.069	-0.062	-0.051	-0.017
28	-0.027	-0.039	-0.027	-0.058	-0.020	-0.053	-0.065	-0.077	-0.069	-0.055	-0.019
30	-0.030	-0.043	-0.030	-0.064	-0.021	-0.058	-0.071	-0.081	-0.074	-0.060	-0.021
32	-0.033	-0.047	-0.033	-0.068	-0.023	-0.061	-0.078	-0.090	-0.082	-0.065	-0.022
34	-0.036	-0.052	-0.036	-0.075	-0.025	-0.068	-0.083	-0.097	-0.087	-0.070	-0.024
36	-0.039	-0.057	-0.039	-0.083	-0.027	-0.073	-0.090	-0.106	-0.095	-0.075	-0.026
38	-0.043	-0.062	-0.043	-0.090	-0.030	-0.078	-0.097	-0.114	-0.104	-0.081	-0.029
40	-0.046	-0.067	-0.046	-0.095	-0.032	-0.084	-0.105	-0.123	-0.111	-0.088	-0.030
42	-0.050	-0.072	-0.050	-0.104	-0.035	-0.089	-0.112	-0.131	-0.118	-0.093	-0.033
44	-0.054	-0.078	-0.054	-0.110	-0.038	-0.096	-0.121	-0.140	-0.126	-0.099	-0.035
46	-0.058	-0.083	-0.057	-0.119	-0.040	-0.103	-0.129	-0.149	-0.134	-0.106	-0.037
48	-0.062	-0.089	-0.061	-0.126	-0.042	-0.109	-0.137	-0.159	-0.145	-0.113	-0.039
50	-0.066	-0.094	-0.065	-0.133	-0.045	-0.116	-0.146	-0.167	-0.151	-0.119	-0.042
52	-0.069	-0.100	-0.068	-0.140	-0.047	-0.123	-0.153	-0.178	-0.159	-0.126	-0.044
54	-0.073	-0.105	-0.072	-0.148	-0.050	-0.130	-0.161	-0.186	-0.168	-0.132	-0.046

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
56	-0.077	-0.110	-0.075	-0.155	-0.053	-0.136	-0.169	-0.195	-0.175	-0.139	-0.047
58	-0.080	-0.115	-0.079	-0.162	-0.055	-0.142	-0.177	-0.203	-0.183	-0.145	-0.049
60	-0.084	-0.120	-0.082	-0.168	-0.058	-0.149	-0.185	-0.211	-0.191	-0.151	-0.051
62	-0.087	-0.125	-0.085	-0.175	-0.061	-0.155	-0.192	-0.219	-0.197	-0.156	-0.053
64	-0.091	-0.129	-0.088	-0.181	-0.063	-0.161	-0.200	-0.228	-0.206	-0.163	-0.055
66	-0.094	-0.134	-0.091	-0.189	-0.065	-0.165	-0.207	-0.236	-0.213	-0.168	-0.057
68	-0.098	-0.139	-0.095	-0.194	-0.067	-0.173	-0.214	-0.243	-0.220	-0.175	-0.059
70	-0.101	-0.144	-0.098	-0.200	-0.069	-0.178	-0.220	-0.251	-0.227	-0.181	-0.061
72	-0.104	-0.148	-0.101	-0.207	-0.072	-0.184	-0.228	-0.259	-0.235	-0.188	-0.063
74	-0.107	-0.152	-0.104	-0.212	-0.074	-0.190	-0.235	-0.266	-0.241	-0.193	-0.066
76	-0.110	-0.156	-0.108	-0.219	-0.076	-0.194	-0.241	-0.274	-0.247	-0.199	-0.068
78	-0.113	-0.161	-0.111	-0.224	-0.078	-0.201	-0.249	-0.281	-0.255	-0.205	-0.070
80	-0.116	-0.164	-0.114	-0.229	-0.080	-0.207	-0.254	-0.287	-0.262	-0.211	-0.072
82	-0.119	-0.169	-0.117	-0.235	-0.082	-0.211	-0.261	-0.295	-0.268	-0.216	-0.074
84	-0.122	-0.173	-0.119	-0.240	-0.084	-0.216	-0.266	-0.301	-0.274	-0.222	-0.076
86	-0.125	-0.176	-0.123	-0.246	-0.086	-0.222	-0.272	-0.307	-0.281	-0.227	-0.078
88	-0.127	-0.180	-0.125	-0.249	-0.089	-0.227	-0.279	-0.313	-0.287	-0.233	-0.081
90	-0.127	-0.179	-0.124	-0.246	-0.090	-0.226	-0.275	-0.310	-0.284	-0.231	-0.082
100	-0.116	-0.163	-0.113	-0.230	-0.087	-0.210	-0.256	-0.289	-0.265	-0.216	-0.079
110	-0.108	-0.152	-0.104	-0.217	-0.084	-0.199	-0.242	-0.273	-0.249	-0.203	-0.076
120	-0.101	-0.142	-0.098	-0.206	-0.081	-0.188	-0.229	-0.259	-0.236	-0.194	-0.075
130	-0.096	-0.135	-0.092	-0.197	-0.079	-0.182	-0.221	-0.248	-0.227	-0.186	-0.072
140	-0.091	-0.128	-0.088	-0.188	-0.077	-0.176	-0.213	-0.239	-0.218	-0.179	-0.071
150	-0.087	-0.122	-0.084	-0.181	-0.076	-0.171	-0.205	-0.231	-0.212	-0.174	-0.070
160	-0.083	-0.117	-0.080	-0.175	-0.074	-0.165	-0.197	-0.223	-0.203	-0.168	-0.069
170	-0.080	-0.113	-0.077	-0.169	-0.072	-0.159	-0.193	-0.216	-0.197	-0.163	-0.067
180	-0.076	-0.108	-0.074	-0.164	-0.071	-0.155	-0.185	-0.208	-0.192	-0.158	-0.066
190	-0.073	-0.104	-0.071	-0.160	-0.069	-0.149	-0.181	-0.203	-0.186	-0.153	-0.065

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
200	-0.071	-0.100	-0.068	-0.154	-0.067	-0.145	-0.174	-0.197	-0.180	-0.149	-0.064
250	-0.057	-0.082	-0.057	-0.129	-0.060	-0.126	-0.149	-0.168	-0.155	-0.130	-0.059
300	-0.046	-0.066	-0.046	-0.109	-0.053	-0.108	-0.129	-0.145	-0.134	-0.112	-0.053
350	-0.037	-0.052	-0.036	-0.092	-0.048	-0.095	-0.111	-0.123	-0.115	-0.097	-0.048
400	-0.029	-0.041	-0.028	-0.078	-0.043	-0.082	-0.095	-0.107	-0.098	-0.085	-0.043
450	-0.021	-0.031	-0.021	-0.065	-0.040	-0.072	-0.083	-0.092	-0.086	-0.075	-0.039
500	-0.016	-0.023	-0.015	-0.053	-0.036	-0.064	-0.072	-0.081	-0.076	-0.066	-0.037
550	-0.010	-0.015	-0.010	-0.045	-0.034	-0.057	-0.065	-0.072	-0.068	-0.060	-0.034
600	-0.007	-0.010	-0.006	-0.039	-0.032	-0.052	-0.058	-0.063	-0.061	-0.054	-0.033
650	-0.003	-0.004	-0.002	-0.032	-0.030	-0.049	-0.052	-0.058	-0.055	-0.050	-0.031
700	0.000	0.001	0.001	-0.026	-0.029	-0.043	-0.047	-0.052	-0.049	-0.046	-0.030
750	OUT	0.004	0.004	-0.023	-0.028	-0.041	-0.043	-0.047	-0.046	-0.042	-0.029
800	OUT	OUT	0.007	-0.019	-0.027	-0.037	-0.039	-0.043	-0.042	-0.040	-0.028
850	OUT	OUT	0.009	-0.014	-0.026	-0.036	-0.034	-0.039	-0.036	-0.037	-0.027
900	OUT	OUT	0.011	-0.009	-0.025	-0.032	-0.033	-0.035	-0.036	-0.034	-0.027
950	OUT	OUT	OUT	-0.007	-0.025	-0.029	-0.030	-0.032	-0.034	-0.032	-0.026
1000	OUT	OUT	OUT	-0.004	-0.024	-0.028	-0.027	-0.029	-0.029	-0.030	-0.025
1200	OUT	OUT	OUT	0.007	-0.022	-0.021	-0.017	-0.017	-0.020	-0.022	-0.024
1400	OUT	OUT	OUT	0.016	-0.021	-0.016	-0.009	-0.008	-0.013	-0.017	-0.023
1600	OUT	OUT	OUT	0.022	-0.020	-0.010	-0.003	-0.001	-0.005	-0.012	-0.023
1800	OUT	OUT	OUT	0.032	-0.020	-0.006	0.003	0.007	0.002	-0.008	-0.023
2000	OUT	OUT	OUT	0.037	-0.019	-0.001	0.008	0.013	0.006	-0.004	-0.023
2200	OUT	OUT	OUT	0.044	-0.019	0.002	0.013	0.019	0.011	0.000	-0.023
2400	OUT	OUT	OUT	0.047	-0.018	0.005	0.017	0.023	0.017	0.003	-0.023
2600	OUT	OUT	OUT	0.055	-0.019	0.007	0.022	0.028	0.019	0.006	-0.023
2800	OUT	OUT	OUT	0.058	-0.018	0.012	0.026	0.034	0.024	0.009	-0.024
3000	OUT	OUT	OUT	0.058	-0.018	0.016	0.031	0.037	0.028	0.011	-0.023
3200	OUT	OUT	OUT	0.058	-0.018	0.018	0.032	0.037	0.029	0.014	-0.024

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
X	-3.50	0.00	3.50	0.00	-6.00	-3.50	-2.00	0.00	2.00	3.50	6.00
Y	-4.00	-4.00	-4.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L1 in.	L2 in.	L3 in.	L4 in.	L5 in.	L6 in.	L7 in.	L8 in.	L9 in.	L10 in.	L11 in.
3400	OUT	OUT	OUT	0.058	-0.018	0.018	0.033	0.042	0.031	0.015	-0.024
3600	OUT	OUT	OUT	0.058	-0.017	0.021	0.036	0.044	0.035	0.017	-0.024
3800	OUT	OUT	OUT	0.058	-0.018	0.020	0.039	0.046	0.037	0.018	-0.024
4000	OUT	OUT	OUT	0.058	-0.018	0.021	0.041	0.051	0.041	0.020	-0.024
4200	OUT	OUT	OUT	0.058	-0.017	0.024	0.042	0.050	0.040	0.020	-0.025
4400	OUT	OUT	OUT	0.058	-0.017	0.026	0.045	0.053	0.042	0.022	-0.024
4600	OUT	OUT	OUT	0.058	-0.017	0.028	0.046	0.055	0.041	0.022	-0.024
4800	OUT	OUT	OUT	0.058	-0.017	0.026	0.045	0.056	0.043	0.023	-0.025
5000	OUT	OUT	OUT	0.058	-0.017	0.029	0.049	0.056	0.044	0.025	-0.025
5200	OUT	OUT	OUT	0.058	-0.017	0.027	0.047	0.057	0.045	0.025	-0.025
5400	OUT	OUT	OUT	0.058	-0.017	0.027	0.049	0.059	0.045	0.025	-0.025
5600	OUT	OUT	OUT	0.058	-0.017	0.027	0.047	0.060	0.047	0.026	-0.025
5800	OUT	OUT	OUT	0.058	-0.017	0.029	0.051	0.058	0.047	0.027	-0.025
6000	OUT	OUT	OUT	0.058	-0.017	0.031	0.049	0.060	0.046	0.027	-0.025
6200	OUT	OUT	OUT	0.058	-0.017	0.030	0.050	0.063	0.048	0.027	-0.025
6400	OUT	OUT	OUT	0.058	-0.017	0.029	0.051	0.063	0.048	0.027	-0.025
6600	OUT	OUT	OUT	0.058	-0.017	0.029	0.051	0.064	0.051	0.028	-0.025
6800	OUT	OUT	OUT	0.058	-0.017	0.030	0.051	0.062	0.050	0.028	-0.025
7000	OUT	OUT	OUT	0.058	-0.017	0.029	0.051	0.063	0.050	0.028	-0.025
7200	OUT	OUT	OUT	0.058	-0.017	0.031	0.052	0.066	0.051	0.029	-0.025
7400	OUT	OUT	OUT	0.058	-0.017	0.032	0.054	0.064	0.052	0.028	-0.025
FINAL	OUT	OUT	OUT	0.058	-0.017	0.032	0.055	0.069	0.052	0.032	-0.025

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
0	-0.009	0.001	0.001	-0.002
2	-0.008	0.000	0.000	-0.002
4	-0.010	-0.002	-0.003	-0.004
6	-0.013	-0.003	-0.006	-0.005
8	-0.015	-0.005	-0.008	-0.007
10	-0.020	-0.007	-0.010	-0.010
12	-0.024	-0.009	-0.014	-0.011
14	-0.028	-0.011	-0.016	-0.013
16	-0.031	-0.013	-0.020	-0.015
18	-0.036	-0.016	-0.023	-0.018
20	-0.042	-0.018	-0.027	-0.021
22	-0.044	-0.021	-0.030	-0.023
24	-0.049	-0.023	-0.034	-0.025
26	-0.054	-0.026	-0.036	-0.028
28	-0.058	-0.028	-0.041	-0.030
30	-0.064	-0.031	-0.044	-0.033
32	-0.070	-0.034	-0.049	-0.036
34	-0.076	-0.037	-0.053	-0.039
36	-0.084	-0.040	-0.058	-0.042
38	-0.090	-0.043	-0.063	-0.045
40	-0.099	-0.047	-0.068	-0.049
42	-0.105	-0.051	-0.074	-0.053
44	-0.113	-0.054	-0.079	-0.056
46	-0.120	-0.058	-0.083	-0.060
48	-0.127	-0.062	-0.090	-0.063
50	-0.133	-0.066	-0.095	-0.067
52	-0.142	-0.070	-0.100	-0.071
54	-0.148	-0.073	-0.106	-0.074

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
56	-0.156	-0.077	-0.110	-0.078
58	-0.163	-0.081	-0.115	-0.081
60	-0.169	-0.084	-0.121	-0.084
62	-0.175	-0.087	-0.126	-0.087
64	-0.183	-0.091	-0.131	-0.090
66	-0.189	-0.094	-0.135	-0.094
68	-0.196	-0.098	-0.140	-0.098
70	-0.202	-0.101	-0.144	-0.101
72	-0.207	-0.104	-0.149	-0.104
74	-0.213	-0.107	-0.154	-0.108
76	-0.220	-0.110	-0.158	-0.111
78	-0.225	-0.114	-0.163	-0.114
80	-0.230	-0.117	-0.167	-0.117
82	-0.236	-0.119	-0.171	-0.120
84	-0.242	-0.122	-0.175	-0.123
86	-0.246	-0.125	-0.179	-0.126
88	-0.251	-0.128	-0.183	-0.128
90	-0.248	-0.127	-0.181	-0.128
100	-0.230	-0.116	-0.165	-0.118
110	-0.217	-0.107	-0.153	-0.109
120	-0.205	-0.100	-0.143	-0.103
130	-0.196	-0.095	-0.135	-0.097
140	-0.189	-0.091	-0.130	-0.093
150	-0.182	-0.087	-0.123	-0.089
160	-0.176	-0.083	-0.118	-0.085
170	-0.170	-0.080	-0.113	-0.082
180	-0.163	-0.076	-0.109	-0.079
190	-0.158	-0.073	-0.104	-0.076

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
200	-0.154	-0.070	-0.100	-0.073
250	-0.130	-0.057	-0.082	-0.061
300	-0.109	-0.046	-0.066	-0.050
350	-0.090	-0.036	-0.053	-0.040
400	-0.077	-0.028	-0.041	-0.032
450	-0.065	-0.021	-0.031	-0.026
500	-0.055	-0.015	-0.023	-0.020
550	-0.047	-0.011	-0.016	-0.015
600	-0.039	-0.007	-0.010	-0.010
650	-0.032	-0.003	-0.005	-0.007
700	-0.028	0.000	0.000	-0.004
750	-0.024	OUT	0.004	-0.001
800	-0.018	OUT	0.008	0.002
850	-0.015	OUT	0.011	0.004
900	-0.012	OUT	0.014	0.007
950	-0.009	OUT	0.018	0.008
1000	-0.005	OUT	0.021	OUT
1200	0.005	OUT	0.032	OUT
1400	0.013	OUT	0.041	OUT
1600	0.021	OUT	0.050	OUT
1800	0.029	OUT	0.058	OUT
2000	0.033	OUT	0.066	OUT
2200	0.040	OUT	0.074	OUT
2400	0.049	OUT	0.082	OUT
2600	0.051	OUT	0.088	OUT
2800	0.058	OUT	OUT	OUT
3000	0.059	OUT	OUT	OUT
3200	0.066	OUT	OUT	OUT

RAPIDLY HEATED PLATE (HASTELLOY-X #3)
LAMP OUTPUT AT 70% (92-0130C)
Time is 17:10:34.79.
Date is 1-30-1992.

LVDT LOCATIONS

AXIS	L12 in.	L13 in.	L14 in.	L15 in.
X	0.00	-3.50	0.00	3.50
Y	2.00	4.00	4.00	4.00
Z	-0.0625	-0.0625	-0.0625	-0.0625

LVDT READINGS

TIME SEC	L12 in.	L13 in.	L14 in.	L15 in.
3400	0.067	OUT	OUT	OUT
3600	0.072	OUT	OUT	OUT
3800	0.075	OUT	OUT	OUT
4000	0.074	OUT	OUT	OUT
4200	0.079	OUT	OUT	OUT
4400	0.080	OUT	OUT	OUT
4600	0.082	OUT	OUT	OUT
4800	0.081	OUT	OUT	OUT
5000	0.085	OUT	OUT	OUT
5200	0.083	OUT	OUT	OUT
5400	0.085	OUT	OUT	OUT
5600	0.087	OUT	OUT	OUT
5800	0.087	OUT	OUT	OUT
6000	0.088	OUT	OUT	OUT
6200	0.089	OUT	OUT	OUT
6400	0.088	OUT	OUT	OUT
6600	0.090	OUT	OUT	OUT
6800	0.091	OUT	OUT	OUT
7000	0.093	OUT	OUT	OUT
7200	0.091	OUT	OUT	OUT
7400	0.089	OUT	OUT	OUT
FINAL	0.093	OUT	OUT	OUT

DISTRIBUTION LIST

1 - 3	National Aeronautics and Space Administration Langley Research Center Hampton, VA 23681-0001 Attention: Allan R. Wieting, Program Manager SMD, M/S 395
4	Mr. R. J. Siebels, Grants Officer M/S 126 National Aeronautics and Space Administration Langley Research Center Hampton, VA 23681-0001
5 - 6*	NASA Scientific and Technical Information Facility P. O. Box 8757 Baltimore/Washington International Airport Baltimore, MD 21240
**	SEAS Postaward Administration
7 - 8	E. A. Thornton
9	R. D. Flack
10 - 11	H. Earnhardt, Clark Hall
12	SEAS Preaward Administration Files

*Reproducible copy
**Cover letter

JO#5838:ph